South Carolina

Long-Term Stewardship Site Highlights

Savannah River Site

Major Activities - institutional controls; surveillance and maintenance; operation/maintenance of treatment systems; and monitoring of engineered units and groundwater
Site Size - 80,127 hectares (198,344 acres)
Estimated Average Annual Cost FY 2000-2006 - $26,474,000

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SAVANNAH RIVER SITE

1.0 SITE SUMMARY

1.1 Site Description and Mission

LONG-TERM STEWARDSHIP HIGHLIGHTS

Major Long-Term Stewardship Activities - institutional controls; surveillance and maintenance; operation/maintenance of treatment systems; and monitoring of engineered units and groundwater
Total Site Area - 80,127 hectares (198,344 acres)
Estimated Volume of Residual Contaminants - to be determined
Portions Requiring Long-Term Stewardship as of 2006 - 10
Average Annual Long-Term Stewardship Cost FY 2000-2006 - $26,474,000
Landlord - U.S. Department of Energy, Office of Defense Programs

The U.S. Department of Energy's Savannah River Site (SRS) produced plutonium and tritium for the nation's defense program from the early 1950s to the late 1980s. SRS now processes, recycles, and stores nuclear materials in support of national defense and nuclear nonproliferation efforts and develops and deploys technologies to improve the environment and treat nuclear and hazardous wastes left over from the Cold War.

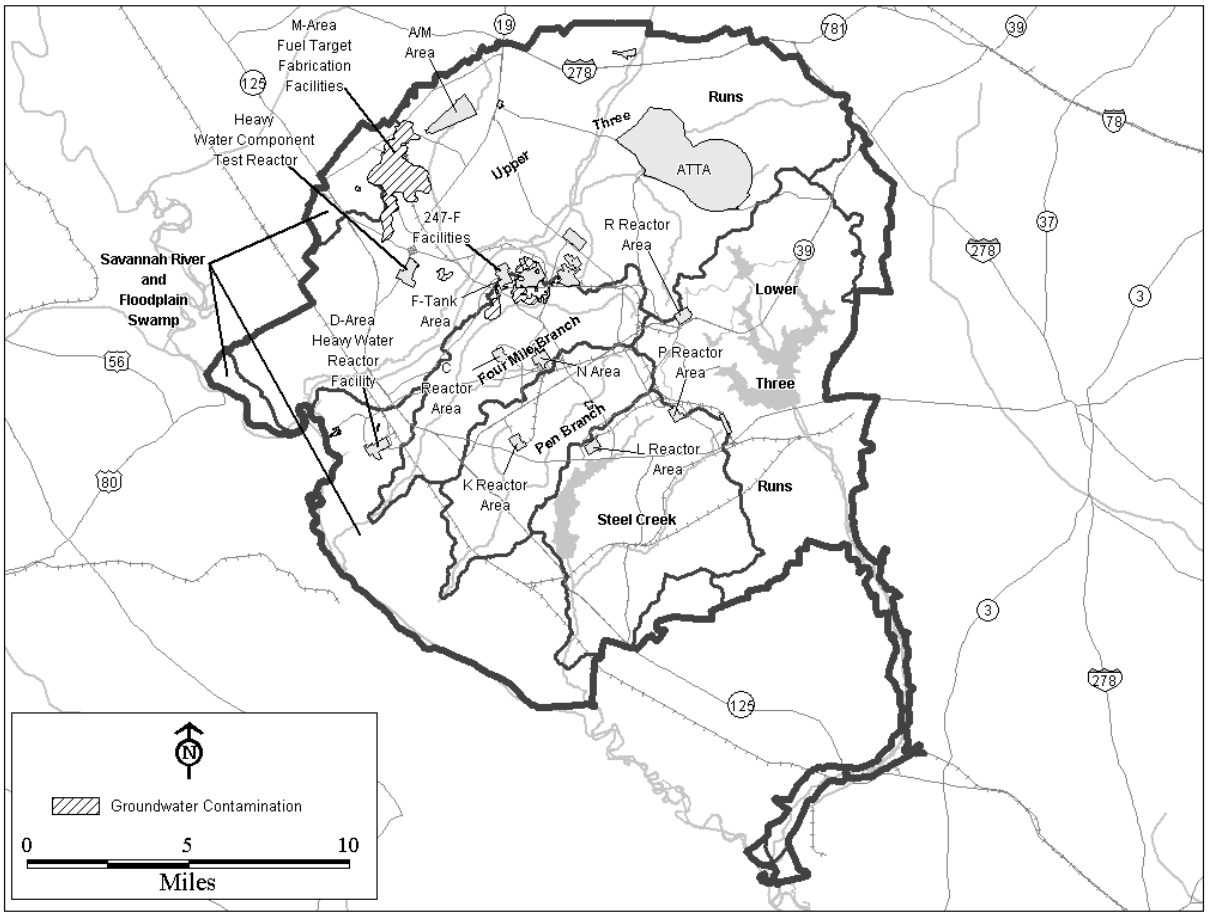
The SRS complex covers 80,127 hectares (198,344 acres), or 803 square kilometers (310 square miles), encompassing parts of Aiken, Barnwell and Allendale counties in South Carolina in a principally rural area. SRS borders the Savannah River and is 40 kilometers (25 miles) southeast of Augusta, Georgia, and 32 kilometers (20 miles) south of Aiken in southwest-central South Carolina. Originally farmland, SRS now encompasses a timber and forestry research center managed by the U.S. Forest Service. Only 10 percent of SRS total area has been developed. SRS is covered by hardwood and pine forests and contains lakes, streams, and Carolina bays and other wetlands. These undeveloped areas provide habitat for a wide variety of plants and animals, including six federally endangered or threatened species and about 70 sensitive species. SRS also houses the Savannah River Ecology Laboratory, an environmental research center operated for DOE by the University of Georgia. The site was designated in 1972 as a National Environmental Research Park.

Historic Mission

The historic mission of SRS, which started in 1950, was to produce strategic isotopes (e.g., plutonium-239 and tritium) for use in the development and production of nuclear weapons. SRS also produced other special isotopes (e.g., californium-252, plutonium-238, and americium-241) to support research in nuclear medicine, space exploration, and commercial applications.

To support the national defense mission, five reactors were built at SRS. Also built were support facilities, including two chemical separations plants, a heavy water extraction plant, a nuclear fuel and target fabrication facility, and waste management facilities. To produce the isotopes, DOE fabricated selected materials into metal targets and irradiated them in SRS's nuclear reactors. The targets were then transferred to the chemical separations facilities (F and H Canyons), where they were dissolved in acid, and where the desired isotopes were chemically separated and converted into a solid form, either an oxide powder or a metal. The oxide or metal was then fabricated into a usable form at SRS or other DOE Sites. In addition, SRS chemically reprocessed spent nuclear fuel to recover uranium-235. From 1953 to 1988, SRS produced about 36 metric tons of plutonium.

After the Cold War, the mission of SRS changed as emphasis shifted from nuclear materials production to environmental management. The fuel and target manufacturing facilities, along with the five production reactors, have been permanently shut down. The processing facilities (F and H Canyons) are currently stabilizing nuclear materials that are considered programmatic or at-risk.



Savannah River Site

Future Missions

Despite the shift in current activities to environmental management, SRS continues to play a major role in Nuclear Material Stewardship and Stockpile Stewardship. Key elements of future missions in these two Stewardship roles are summarized below.

- SRS has been designated to continue as DOE's center for the supply of tritium to the enduring nuclear weapons stockpile and, thus, will perform tritium extraction from fuel rods irradiated in one of the Tennessee Valley Authority's reactors. A new tritium extraction facility is scheduled to go on line in 2006.

- SRS has been selected to "blend down" off-specification highly enriched uranium from retired weapons components and reactor fuel to low-enriched uranium that can be used in commercial nuclear reactors.

- SRS was designated as the lead Site for managing the consolidation of surplus plutonium materials from within the DOE complex and, earlier this year, was selected as the Site for three new plutonium disposition facilities (pit disassembly and conversion, mixed oxide fuel fabrication, and plutonium immobilization).

- SRS is the Site designated for management of aluminum-based spent nuclear fuel, from both domestic research reactors and foreign research reactors, until the spent nuclear fuel can be processed into a suitable form and/or packaged and shipped to a geologic repository for disposal. SRS also continues to prepare high-level wastes (through vitrification at the Defense Waste Processing Facility) for shipment to a geologic repository for disposal.

- SRS continues to provide leadership in environmental and waste management technology development and deployment and continues efforts to clean up the Site (i.e., remediate contaminated facilities, soils, and groundwater) and manage wastes and materials until they are permanently dispositioned.

1.2 Site Cleanup and Accomplishments

1.2.1 Remediation of Contaminated Sites

During SRS's 35-year production mission, contaminants were potentially released at 515 "inactive waste sites" (soil, surface water, and groundwater). This contamination represents:

- About 160 million cubic meters (5,650 million cubic feet) of environmental media contaminated with hazardous substances (e.g., volatile organic compounds (VOCs), heavy metals, and pesticides)

- About 12 million cubic meters (423 million cubic feet) of environmental media contaminated with both radionuclides and hazardous substances

These inactive waste sites, or units, include:

- settling/seepage basins,
- burning/rubble pits and piles,
- groundwater units,
- burial grounds/tanks,
- spill sites, and
- miscellaneous units.

APPROACHES TO REMEDIATION

Soils

- Soil Vapor Extraction
- Bioremediation
- Engineered Landfill Capping
- Solidification and Backfill
- Land Use Controls

Groundwater

- Air Recirculation Systems
- Vapor Extraction
- Baroballs
- Phytoremediation
- Pump and Treat
- Air Sparging
- Bioremediation
- Geosiphon
- Dynamic Underground Stripping

Environmental remediation work has been prioritized to focus on the higher risk sites. A major goal is to remediate, or begin to remediate, all high-risk/priority units by the end of 2006, while maintaining a balanced program for the remaining medium and low-risk units. Since remediation work started a decade ago:

- over 300 of the 500 contaminated acres have completed remediation, or are in the remediation phase, including the high priority Burial Ground Complex;

- over 40% of the 515 inactive waste sites at SRS have completed remediation and over half are in the remediation phase; and

- over four billion gallons of contaminated groundwater have been cleaned to drinking water standards, and major groundwater cleanup systems are operating at nine contaminated groundwater sites.

Remediation options for the inactive waste sites are varied and are determined on a site-specific basis. Most methods combine some aspects of waste stabilization, site capping, waste removal, and grading. Remediation activities also include innovative technologies, such as horizontal wells vapor vacuum extraction and air strippers, and include groundwater monitoring and periodic groundwater quality assessments.

Programmatically, all waste units in the Environmental Restoration program at SRS follow the same protocols for investigation, development of remedial action, and the selection of cleanup levels. Also, units within each watershed at SRS have similar sources of contamination and, thus, similar types of contamination, which would lead to similar cleanup goals and residuals. Programmatically, all the cleanup goals, thus the residual contamination levels, will be similar for each contaminant no matter what unit. For example, levels protective of the industrial worker or Maximum Contaminant Levels (MCLs) for groundwater will be applied to the majority of the operable units within the SRS watersheds and the Environmental Restoration program. Providing specific information for each operable unit within the watershed will not provide more beneficial information than is already discussed at the watershed (or portion) level. It would only serve to provide the same information on each unit (i.e., the same information would be repeated for each unit). For example, both the TNX and D-Area groundwater contamination (discussed in Section 3.11) consists of volatile organic compounds, metal, and radionuclides. The cleanup levels will be similar, as will the residuals.

KEY ACCOMPLISHMENTS IN FY 1999

- Produced 236 canisters of vitrified high-level waste (HLW).
- Received 28 casks of foreign research reactor (FRR) spent nuclear fuel (SNF) and 21 casks of domestic research reactor (DRR) SNF.
- Completed first cross-country shipment of FRR SNF (non-aluminum based) to the Idaho National Engineering and Environmental Laboratory (INEEL), supporting non-proliferation initiatives.
- Completed repackaging of existing SRS plutonium metal in FB-Line Bagless Transfer containers in preparation for mid- to long-term stable storage.
- Completed construction and began operation of new material characterization equipment in FB-Line.
- Shipped 17 casks of SNF material to H Canyon from K Reactor (at-risk materials).
- Completed shipments to F Canyon and stabilization in the FB Line of “failed” Taiwan fuel and “failed” EBR II fuel.
- Completed stabilization of Rocky Flats sand, slag, and crucible plutonium residues in F Canyon.
- Processed 68 million liters (18 million gallons) of wastewater at the Effluent Treatment Facility.
- Reduced legacy hazardous waste inventory by at least 260 cubic meters (9,170 cubic feet).
- 7,300 cubic meters (258,000 cubic feet) of low-level radioactive waste (LLW) added to inventory; treated about 4,900 cubic meters (173,000 cubic feet) and disposed about 8,800 cubic meters (311,000 cubic feet) of LLW.
- Completed retrieval of 2,500 buried transuranic (TRU) waste drums.
- Recycled 6,940 kilograms (15,300 pounds) of radioactively-contaminated lead.
- Completed material castings for the initial examinations of Melt/Dilute concepts.
- Achieved effective steady state operation at F&H Groundwater Treatment Facilities.
- Successfully deployed and saved over $10 million, using innovative technologies for the third consecutive year in environmental management program (i.e., in-situ air sparging, Soil Vapor Extraction (SVE), and in-situ soil stabilization.
- Remediated 13 key waste sites and groundwater units, such as in situ grouting at Old F-Area Seepage Basin, groundwater treatment at C-Area waste unit, and bio-remediation at Nonradioactive Waste Disposal Facility.

KEY PLANNED ACCOMPLISHMENTS IN FY 2000

FY 2000 Commitments

- Produce canisters of vitrified HLW from tanks at an average rate of 200 canisters per year.
- Receive 15 casks of foreign research reactor spent nuclear fuel and 23 casks from domestic reactors.
- Ship 12 casks of spent nuclear fuel material (subject to Defense Nuclear Facilities Safety Board Recommendation 94-1) and 13 casks of SRS spent nuclear fuel materials (pending Record of Decision) to SRS canyon facilities.
- Deinventory 10 casks of spent nuclear fuel in the Receiving Basin for Off-Site Fuels (RBOF) to the L Basin.
- Complete remediation of 10 release sites and assessments of 10 other sites.
- Complete grouting of radioactively contaminated soils at L-Area Oil and Chemical Basin and F-Area Retention Basins.
- Treat 1,320 million liters (350 million gallons) of groundwater and remove 45 thousand kilograms (100 thousand pounds) of volatile organic compounds from the A/M-Area.
- Remove radioactive contaminated soil from four SRL seepage basins near the site boundary.
- Begin operation of the Replacement High-Level Waste Evaporator (RHLWE).
- Complete construction of the H-Tank Farm Storm Water System upgrades.
- Treat approximately 7,570 liters (2,000 gallons) of PUREX solvent in the Consolidated Incinerator Facility (CIF).
- Complete stabilization of SRS depleted uranium/plutonium by conversion to metal.
- Begin stabilization of Mark-42 and non-failed EBR II fuel (pending Record of Decision).
- Receive five Rocky Flats shipments of scrub alloy for stabilization through F-Canyon/FB-Line.

KEY PLANNED ACCOMPLISHMENTS IN FY 2001

FY 2001 Planned Accomplishments

- Produce canisters of vitrified HLW from tanks at an average rate of 200 canisters per year.
- Make four shipments of TRU waste to WIPP.
- Begin receipt of stabilized surplus plutonium from Rocky Flats.
- Commence deactivation of the 313-M Target Slug Manufacturing Facility.
- Complete the experimental basin water strontium/cesium removal technology demonstration.
- Complete Melt and Dilute Pilot construction and startup as an alternative technology to conventional chemical processing of aluminum-based SNF.
- Process 68 million liters (18 million gallons) of wastewater at the Effluent Treatment Facility.
- Demolish the F Area powerhouse.
- Complete Sludge Batch 1B feed to Defense Waste Processing Facility (DWPF), and initiate Sludge Batch 2 feed.
- Complete assessments of eight release sites and remediation of eight release sites.
- Begin final action on the Radioactive Burial Ground and its groundwater unit.
- Operate nine major long-term groundwater cleanup systems.
- Complete stabilization of SRS depleted uranium/plutonium by conversion to metal.
- Initiate stabilization of Rocky Flats scrub alloy through F-Canyon/FB-Line.
- Refresh and consolidate existing inventory of HEU solution pending future initiation of Blend-Down Program.
- Receive 25 casks of foreign research reactor SNF and 16 casks from domestic research reactors.
- Ship 10 casks of SNF material (subject to Defense Nuclear Facilities Safety Board Recommendation 94-1) and 17 casks of SRS spent nuclear fuel materials.
- Deinventory 24 casks of RBOF SNF to the L Basin.

1.2.2 Disposition of Onsite Wastes and Materials

In addition to cleaning up site contamination at SRS, DOE is actively working to disposition the various types of wastes and nuclear materials that are currently stored on the Site.

- About 132 million liters (35 million gallons) of high-level waste are stored in waste tanks at SRS. DOE is working to remove the high-level waste from 49 remaining tanks and stabilize and close the tanks. Two have already been closed. The Defense Waste Processing Facility (DWPF) is converting the liquid high-level waste into a borosilicate glass waste form, a stable storage form, which will ultimately be shipped to a geologic repository for permanent disposal. Low-level waste saltstone, also resulting from this process, will be disposed of at an onsite vault.

- About 2,200 cubic meters (77,000 cubic feet) of mixed low-level waste are currently in inventory, and over 11,000 additional cubic meters (388,000 cubic feet) are expected to be generated over the life cycle of cleanup operations. After a range of treatment activities, 3,600 cubic meters (127,000 cubic feet) are expected to be disposed of at an offsite facility. SRS hosts a mixed low-level waste treatment facility (the Consolidated Incineration Facility), which currently treats only onsite waste.

- About 15,000 cubic meters (529,000 cubic feet) of low-level waste are currently in inventory, and over 213,000 meters (7.5 million cubic feet) are expected to be generated over the life cycle of cleanup operations. After a range of treatment activities, 125,000 cubic meters (4.4 million cubic feet) will be disposed of onsite in either engineered vaults or slit trenches (shallow land burial); 33,000 cubic meters (1.2 million cubic feet) will be sent to an offsite commercial facility; and three million cubic meters (106 million cubic feet) of treated effluent will be discharged through a National Pollutant Discharge Elimination System outfall. Currently, SRS projects to generate and dispose onsite more low-level waste than any other DOE Site. This will require expansion of the onsite low-level waste disposal facilities.

- About 11,000 cubic meters (36,080 cubic feet) of transuranic waste are currently in inventory (primarily stored in drums and black boxes) and 3,800 cubic meters (12,464 cubic feet) are expected to be generated over the life cycle of cleanup operations. After a combination of sorting, segregating, and repackaging, 16,000 cubic meters (52,480 cubic feet) are planned for shipment to the Waste Isolation Pilot Plant (WIPP) for permanent geologic disposal.

- Nonradioactive hazardous waste is being shipped offsite for treatment, incineration, or recovery. More than 2,500 drums have been shipped offsite. About 500 cubic meters (1,640 cubic feet) per year of nonradioactive hazardous waste are shipped offsite for treatment, incineration, or recovery.

- About 20 metric tons of heavy metal (MTHM) of spent nuclear fuel are in inventory and 30 MTHM are expected to be received from offsite. After onsite management, the spent fuel is expected to be placed in an offsite geologic repository for permanent disposal. About 47 metric tons of heavy metal (MTHM) of spent nuclear fuel were in the SRS inventory at the end of 1999. Of these inventories, about 24 MTHM will undergo stabilization processing in the SRS canyon facilities and 20 MTHM will be shipped to the Idaho National Engineering and Environmental Laboratory (INEEL) as part of the *Record of Decision on Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs* (May 1995), which specified consolidation of spent nuclear fuel by fuel type at either Hanford, INEEL or SRS. The remaining three MTHM inventory will be combined with projected receipts of 20 MTHM of aluminum-based foreign and domestic research reactor spent nuclear fuel and stabilized in the SRS Treatment and Storage Facility (melt and dilute) for emplacement and final disposition in the geologic repository.

- 2.1 metric tons of surplus plutonium materials are in inventory at SRS and about 30 metric tons are expected to be received from offsite for either immobilization or fabrication into mixed oxide fuel for use in domestic nuclear power reactors. The vitrified plutonium and spent mixed oxide fuel will ultimately be placed in an offsite geologic repository for permanent disposal.

These waste and materials management activities are not the subject of this report, except for where the facilities or waste units are in remediation or deactivation and will begin long-term stewardship activities by 2006.

DOE assumes, for purposes of long-term stewardship, that these wastes and materials will be removed offsite for permanent disposition (except for the low-level waste, which will be buried in onsite vaults or trenches, in accordance with requirements governing low-level waste disposal facilities). However, in the event of schedule delays, i.e., availability of a geologic repository for high-level waste and spent nuclear fuel, DOE would be managing these materials onsite as part of its long-term stewardship responsibilities.

1.2.3 Deactivation of Facilities

Deactivation of most of the Site's major processing facilities (such as the five reactors, two chemical separation facilities, and Defense Waste Processing Facility) has been deferred beyond 2006. Two of the five reactors are being modified for plutonium storage (K Reactor) and spent nuclear fuel treatment and storage (L Reactor) and will remain active until 2014 and 2036, respectively. Current assumptions are that the chemical separation facilities (F and H Canyons) will continue to support EM missions through 2009. Stabilized plutonium will be packaged and stored in the 235-F vault until final disposition is completed in 2020. The Defense Waste Processing Facility (DWPF) will continue vitrifying high-level waste through 2023. Upon completion of their current EM mission, the facilities will be deinventoried and deactivated. Following deactivation, facilities will be placed in a long-term, low-cost surveillance and maintenance program pending final decommissioning.

As can be seen from the above discussion, SRS is not a near-term "closure site." Detailed planning for facilities disposition and negotiations with Regulators regarding the final disposition of Site facilities is still years away. In addition, future technologies for facilities cleanup will have a dramatic effect on cost. For these reasons, final Site decisions on the ultimate end state of most of the facilities have not been made yet. The SRS planning assumption to deactivate facilities, followed by long-term surveillance and maintenance, ensures the safety of workers, the public, and the environment and does not preclude any ultimate end-state options. The long-term stewardship cost estimate developed for the SRS life-cycle Environmental Management (EM) cost estimate can be applied to a range of facility disposition options, which will be identified as discussions with regulators are initiated, new technologies are evaluated, and detailed disposition plans are developed.

Since decisions on the final end states for most of the Site's facilities will be made after 2006, this report contains cost estimates only for facilities that will have begun long-term stewardship activities by the end of 2006. These include a portion of the high-level waste tanks, the D-Area Heavy Water Facilities, the Heavy Water Component Test Reactor (HWCTR), the Naval Fuel Manufacturing Facility (247-F), and the M-Area Fuel/Target Manufacturing Facilities.

2.0 SITE-WIDE LONG-TERM STEWARDSHIP

2.1 Long-Term Stewardship Activities

Decisions regarding the final disposition of Site facilities will be made during the disposition detailed planning phase (typically initiated three years prior to the completion of scheduled facility operations). The decisions will be consistent with regulatory requirements, input from stakeholders, future use of Site resources, available technology, and cost-effectiveness considerations (see Section 1.2.3 above). The current planning basis is to

monitor and maintain Site facilities indefinitely (for purposes of this report, through 2070) to ensure their structural integrity and protect the health and safety of Site workers, the general population outside the site boundaries, and the environment.

DOE anticipates that DOE/EM Environmental Restoration operating activities at SRS, including well monitoring, maintenance of treatment facilities, maintenance of institutional and engineered controls, and compliance support, will be completed by 2047. Following the operating period, the remediated release sites will be monitored and maintained in perpetuity (estimated, for purposes of this report, through 2070) to ensure the containment of any residual contamination.

Section 3.0 provides a further discussion of those areas of the Site that will require long-term stewardship activities by 2006 (as requested by Congress in the FY 2000 National Defense Authorization Act), referred to as "portions." For purposes of this report, a "portion" is a geographically contiguous and distinct area (which may involve residually contaminated facilities, engineered units, soil, groundwater, and/or surface water/sediment) for which cleanup, disposal, or stabilization will have been completed by 2006 and for which there are long-term stewardship requirements prior to 2006.

General activities involved in long-term stewardship (e.g., institutional and engineered controls, and record-keeping) are discussed below. However, since long-term stewardship activities are dependent on the particular waste site or facility, each portion discussion in Sections 3.1 to 3.11 elaborates, where appropriate, on long-term stewardship activities specific to that portion.

Institutional and Engineered Controls

Long-term surveillance and maintenance will be performed for waste units that have been remediated (or are being remediated through monitored natural attenuation). Activities include required regular maintenance, such as erosion control, placement of signs, fence repair, periodic inspections, and monitoring. Maintenance will be performed on secondary roads, drainage systems, and access roads to monitoring wells. Upon completion of closure activities, periodic inspection of the units will be performed in accordance with approved post-closure inspection procedures.

DOE assumes that the Site will continue to maintain its Industrial Use zoning and, therefore, access will be restricted during long-term stewardship. (See description of SRS land use planning zones in Section 4.0.)

Record-Keeping Activities

The U.S. Environmental Protection Agency, Region IV, requires that all Federal Facilities within the Region commit themselves to implementing a detailed written Land Use Control Assurance Plan for any remedial and/or corrective action involving any reliance on one or more Land Use Controls for the protectiveness of that action. This Plan must be established for all remedial actions under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) and corrective actions under the *Resource Conservation and Recovery Act* (RCRA) that utilize Land Use Controls as all or part of their remedy. A unit-specific Land Use Control Implementation Plan is established for each waste site that implements land use controls as all or part of their remedy. These unit-specific plans are appended to the Land Use Control Assurance Plan.

The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC-RP-98-4125) was established in April 2000. As the unit-specific land use control implementation plans are developed, they will be appended to the Land Use Control Assurance Plan. Anyone desiring to read about the land use controls being implemented at SRS can obtain a copy of the Land Use Control Assurance Plan (see contact information at end of Section 4.0).

The above requirements apply to the Site's Environmental Restoration Program. Record-keeping requirements for dispositioned Site facilities will be developed on a case-by-case basis during the detailed planning phase of the facility disposition effort.

STAKEHOLDER INVOLVEMENT

SRS involves the public in key decisions and planning activities. Public input is considered in strategic planning, comprehensive planning, siting new facilities, decommissioning surplus facilities, environmental research, and remediation decisions. The public has an opportunity to be involved in SRS activities through participation in Citizens Advisory Board meetings and DOE public meetings and by providing comments on draft documents, priorities and budgets. Current information on SRS activities can be found on the SRS website: www.srs.gov.

Stakeholder recommendations concerning future use options for SRS, with few exceptions, have fit several common themes:

- SRS boundaries should remain unchanged, and the land should remain under the ownership of the federal government, consistent with the Site's designation as the first National Environmental Research Park (NERP).
- Residential uses of SRS land should be prohibited.
- All SRS land should be available for multiple use, except for residential use (e.g., industry, ecological research, natural resource management, research and technology demonstration, recreation, and public education) wherever appropriate and non-conflicting.
- Some of the land should continue to be available for nuclear and non-nuclear industrial uses, and commercial industrialization should be pursued.
- Industrial and environmental research and technology development and transfer should be expanded.
- Natural resource management should be pursued wherever possible with biodiversity as the primary goal
- Recreational opportunities should be expanded as appropriate.
- Future use planning should consider the full range of worker, public, and environmental risks, benefits, and costs associated with remediation.

Stakeholders expressed a broad range of concerns related to the level of risk, benefits, and costs that should be evaluated before decisions are made. Concerns addressed both potential onsite and offsite impacts. Most expressed the desire that the health and safety of workers, the public, and the environment be the primary consideration in planning the future of SRS. They also advocated increased consideration of risks, benefits, and costs associated with future Site activities, particularly where future remediation activities were concerned.

2.2 Long-Term Stewardship Technology Development and Deployment

Technology initiatives will include performing programmatic initiatives and process improvements for technical activities, such as technology development, risk assessment initiatives, codes and standards, training, software research, safety documentation, and configuration management. Benefits include varied technologies and process improvements that are deployed to specific waste sites, remediation activities, and regulator interface and cost savings to the Environmental Restoration program. By establishing protocols, performing root cause investigations and developing regulator document templates and procedures for Environmental Restoration work, technology initiatives are essential to the long-term stewardship planning.

2.3 Assumptions and Uncertainties

DOE assumes that the Site will remain under the federal government ownership under its current boundaries in perpetuity. Because SRS will have continued missions for the foreseeable future, DOE assumes that the Site will

remain zoned for industrial, industrial support, and general uses (see Section 4.0). Therefore, long-term stewardship activities will be appropriate.

DOE assumes that the DOE/EM mission at SRS will be complete by 2047; however, the long-term stewardship scope and cost for deactivated facilities and remediated soils and water have been included in the life-cycle cost estimates and are considered as part of the Environmental Management liability beyond that time (for purposes of this report, through 2070).

While much is understood concerning the contaminants at many of the operable units discussed in this report, additional characterization and treatability studies are required in some areas to fully understand the nature and extent of the contamination.

2.4 Regulatory Regime

The environmental cleanup program at SRS is governed by a variety of regulatory requirements, including state and federal laws, interagency agreements, DOE Orders, and various settlement agreements and consent decrees. In 1989, SRS was placed on the National Priority List for response under CERCLA. DOE has performed remedial investigations at inactive waste units at SRS, most of which were included in the 1987 RCRA permit issued by EPA as solid waste management units. In addition, DOE integrated the process at SRS for conducting Remedial Investigations and RCRA Facility Investigations for those waste units covered under both statutes.

As required by Section 120(e) of CERCLA, DOE, EPA, and the South Carolina Department of Health and Environmental Control (SCDHEC) entered into an interagency agreement, the Federal Facility Agreement (FFA), that became effective August 16, 1993. EPA also is a party to the FFA, and the FFA integrates the requirements of RCRA and CERCLA by defining the process for integrated responses and contains an enforceable schedule for current year activities and outyear schedules. An FFA Implementation Plan (FIP) has been developed to aid the three Parties in their task of administering the terms of the FFA.

Additional federal and state statutes and regulations affect responses at SRS cleanup sites on a project-specific basis. These include the National Environmental Policy Act, Clean Water Act, Clean Air Act, Toxic Substances Control Act, South Carolina Pollution Control Act, South Carolina Storm-Water Management and Erosion Control Regulations, and South Carolina Solid Waste Regulations.

The above requirements apply to the Site's Environmental Restoration program. The regulatory regimes for the Site's facility disposition activities will be developed on a case-by-case basis during the detailed planning phase, based on then-current regulatory requirements.

2.5 Estimated Site-Wide Long-Term Stewardship Costs

As stated in Section 1.2.3, decisions on the final end state for most of the Site's facilities are years away, and current estimates for long-term stewardship are based on prudent, but conservative, assumptions (deactivation versus full D&D). This approach was selected to provide Site life-cycle cost estimates that are a good barometer for measuring the total Environmental Management liability rather than just the long-term stewardship component. (This approach is less susceptible to future regulatory decisions and improvements in future technologies as they pertain to long-term stewardship.) Therefore, consistent with the language in the FY 2000 National Defense Authorization Act ("*In those cases where the Department has a reasonably reliable estimate of annual or long-term costs for stewardship activities, such costs shall be provided*"), the table below summarizes the cost for the site portions that will be in long-term stewardship by the end of fiscal year 2006. These estimates include:

- Site Environmental Restoration operating activities (pump and treat) that are in place prior to 2006, which have been identified, for the purpose of this report, as long-term stewardship activities.

- Post-deactivation activities for surveillance and maintenance of deactivated facilities/structures that are in place prior to 2006 to ensure the containment of any residual contamination.

In the years FY 2000 to FY 2006, the costs are dominated by the Environmental Restoration program and reflect the extensive pump and treat systems currently in place to remediate and prevent migration of contaminated groundwater. Costs also reflect the routine institutional and engineered controls involved in long-term stewardship.

In the portion-specific discussions in Section 3, applying to the Environmental Restoration program (e.g., the watershed portions), cost estimates are provided through the anticipated dates for which DOE/EM operations phases of the program are scheduled for completion. Each portion has its own projected end date, consistent with interim regulatory commitments.

Site Long-Term Stewardship Costs (Constant Year 2000 Dollars)					
Year(s)	***Amount***	***Year(s)***	***Amount***	***Year(s)***	***Amount***
FY 2000	$35,001,000	**FY 2008**	$9,523,000	**FY 2036-2040**	$17,255,000
FY 2001	$29,082,000	**FY 2009**	$ 7,380,000	**FY 2041-2045**	$21,967,000
FY 2002	$27,889,000	**FY 2010**	$6,406,000	**FY 2046-2050**	$28,035,000
FY 2003	$22,659,000	**FY 2011-2015**	$20,889,000	**FY 2051-2055**	$35,781,000
FY 2004	**$**21,390,000	**FY 2016-2020**	$16,137,000	**FY 2056-2060**	$45,667,000
FY 2005	$23,519,000	**FY 2021-2025**	$12,829,000	**FY 2061-2065**	$58,283,000
FY 2006	$25,779,000	**FY 2026-2030**	$11,873,000	**FY 2066-2070**	$74,385,000
FY 2007	$14,010,000	**FY 2031-2035**	$14,134,000		

3.0 PORTION OVERVIEW

The discussion of long-term stewardship is organized according to 11 portions of SRS. Six of those portions are within geographical areas with common topography and hydrology (i.e., watershed areas). The portion itself represents areas of contamination that will have begun long-term stewardship by 2006 (e.g., soil, engineered units, or groundwater). Four portions are facilities that have been or will be deactivated by 2006. One portion includes the F-Tank Area, for which long-term stewardship costs do not begin for the tank area as a whole until FY 2022. However, some of the tanks in the F Area will be emptied of their high-level radioactive waste and "operationally closed" by 2006. The emptied and operationally closed tanks will be under institutional control and monitored as part of the operating tank farm until the final closure is completed in 2022.

The table below identifies the 11 portions and the timeframes for long-term stewardship by DOE. The sections below provide more details on the remediation or deactivation activities taking place at the 11 portions and the anticipated long-term stewardship activities. For ease in presentation of remedial actions, the portions are further broken down by environmental media type, e.g., soil, engineered units, and groundwater. However, long-term stewardship activities are discussed at the portion level.

Long-Term Stewardship Information		
Portion	***Long-Term Stewardship Start Year***	***Long-Term Stewardship End Year***
F-Tank Area (entire tank area)	2022	indefinite
D Area Heavy Water Facilities	2004	indefinite
Heavy Water Component Test Reactor (HWCTR)	2007	indefinite
247-F Naval Fuel Manufacturing Facility	1997	indefinite
M Area Fuel/Target Fabrication Facilities	2007	indefinite
Upper Three Runs	1996	in perpetuity
Lower Three Runs	1997	in perpetuity
Steel Creek	1996	in perpetuity
Pen Branch	2001	in perpetuity
Four Mile Branch	1996	in perpetuity
Savannah River and Floodplain Swamp	1997	in perpetuity

3.1 F-Tank Area

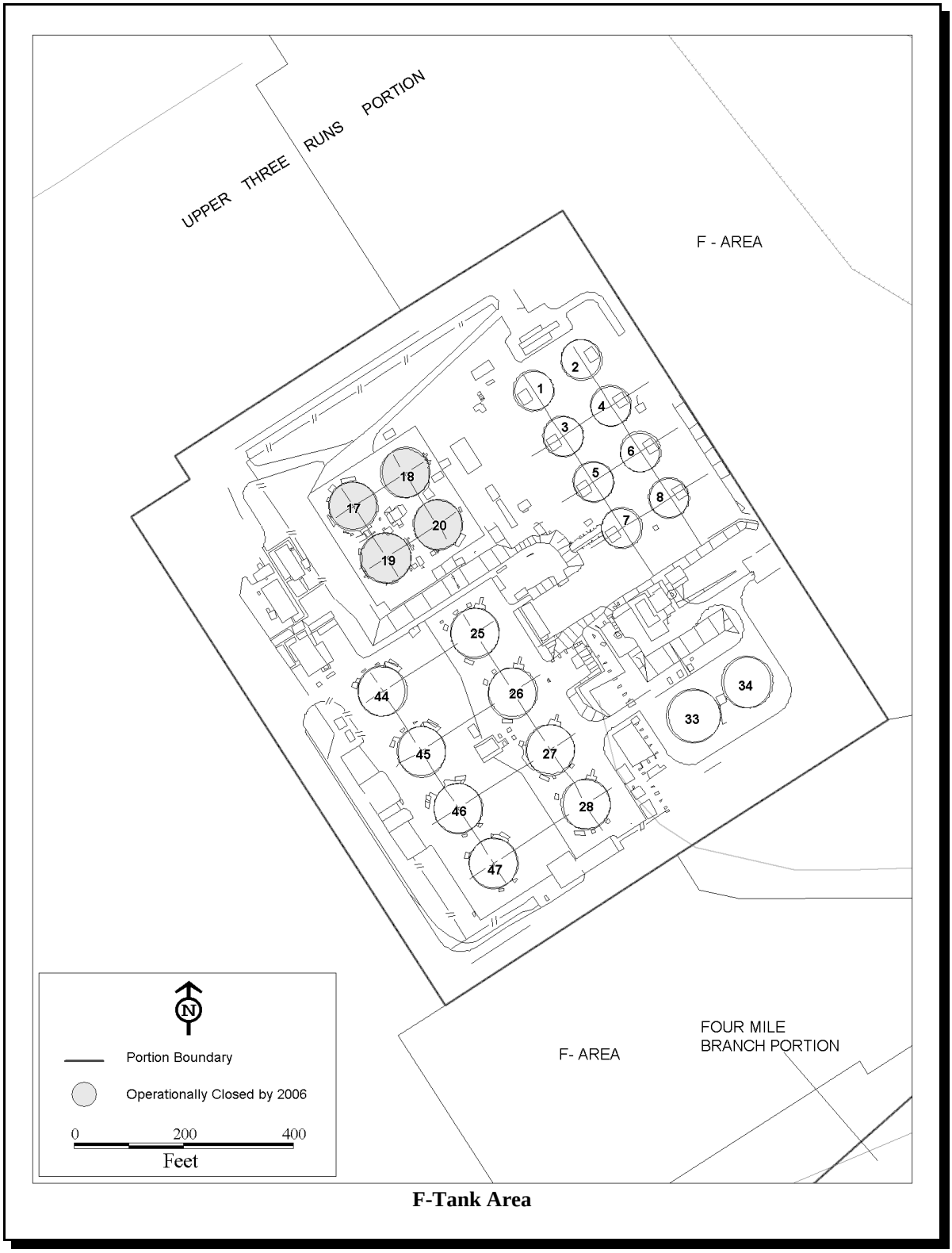
F-TANK AREA PORTION HIGHLIGHTS

Major Long-Term Stewardship Activities - institutional controls; long-term surveillance and maintenance
Portion Size - 7.7 hectares (19 acres); contains 22 of 51 high-level waste tanks
Estimated Volume of Residual Contaminants - to be determined
Long-Term Stewardship Start-End Years - 2022-indefinitely
Average Annual Long-Term Stewardship Costs FY2000-2006 - n/a

The F-Tank Area is a separately fenced portion of SRS, comprising 7.7 hectares (19 acres) and containing 22 of the 51 high-level waste storage tanks at SRS. (The remaining tanks are located in the H-Tank Area.) The high-level waste contained in the storage tanks are in liquid and sludge forms and resulted from the chemical processing of spent fuel and irradiated targets (to separate plutonium for use in the nuclear weapons program). As part of the Federal Facility Agreement, DOE is required to remove from service and close the non-compliant tanks, in accordance with South Carolina Regulation R.61-82, "Proper Closeout of Wastewater Treatment Facilities," and consistent with other requirements governing high-level waste and hazardous materials.

The final end-state for all of the high-level waste tanks (including F- and H-Area Tanks) is scheduled for 2024. Closing the tanks requires first removing the liquid high-level waste and waste heels from the tanks, separating and decontaminating the salt portion of the waste (for disposal as saltstone), vitrifying the highly radioactive liquid and sludge into glass logs for eventual disposal in a geologic repository, and stabilizing and closing the tanks (including capping and sealing all piping). The saltstone disposal vaults will be covered with native soil and a cap will be installed, consisting of layers of clay, gravel, geotextile fabric, and other materials.

Two of the 51 high-level waste storage tanks (Tanks 17 and 20 in the F Area) have already been operationally closed. After removal of the high-level waste and spray washing, the tanks were filled with a specially



F-Tank Area

formulated grout mixture to bind up residual contamination. The remaining 49 tanks in both the F and H Tank Areas have yet to be closed. The separation and decontamination of the salt portion of the waste become

technologically challenging, from a health and safety standpoint, and efforts are now underway to evaluate the most appropriate technology to accomplish this task..

By 2006, DOE anticipates that two additional tanks (old-style tanks that have been emptied of waste) will be operationally closed (Tanks 18 and 19 in the F Area). Therefore, by the end of 2006, a total of four tanks will have been operationally closed. Since all four of the tanks in the tank group 17-20 will have been operationally closed, the common supporting infrastructure for this tank group will also be operationally closed.

3.1.1 Long-Term Stewardship Activities

Long-term stewardship activities will not begin until 2022, when both the F and H Tank Areas, as a whole, will be emptied and closed. For the four tanks operationally closed by 2006, some level of monitoring and institutional controls will be maintained as part of ongoing tank area programs. DOE anticipates that once the tank areas are closed, institutional controls and long-term surveillance and maintenance will be required in perpetuity. The duration for environmental monitoring of the tank areas is undetermined at this time.

3.1.2 Estimated Long-Term Stewardship Costs for the F-Tank Area Portion

The F Tank Farm will be operating through the end of 2021 with final closure in 2022, at which time long-term stewardship activities will begin. Due to current uncertainties in the technology and methodology that will be selected to operationally close the remaining tanks and facilities, current cost estimates contain a high degree of uncertainty and are, therefore, not included in this report.

3.2 D Area Heavy Water Facilities

The 400-D-Area Heavy Water facilities produced heavy water for use in the production reactors. The area originally contained three sets of heavy water extraction towers with the necessary support facilities. The area was operational until 1982. There is no planned reuse for the facilities. In 1995, two sets of extraction towers and most support facilities were removed. The facilities began deactivation in 1999 and are expected to complete deactivation in 2003, at which time they will remain in a long-term monitoring mode until a final decision is made on the disposition of these facilities.

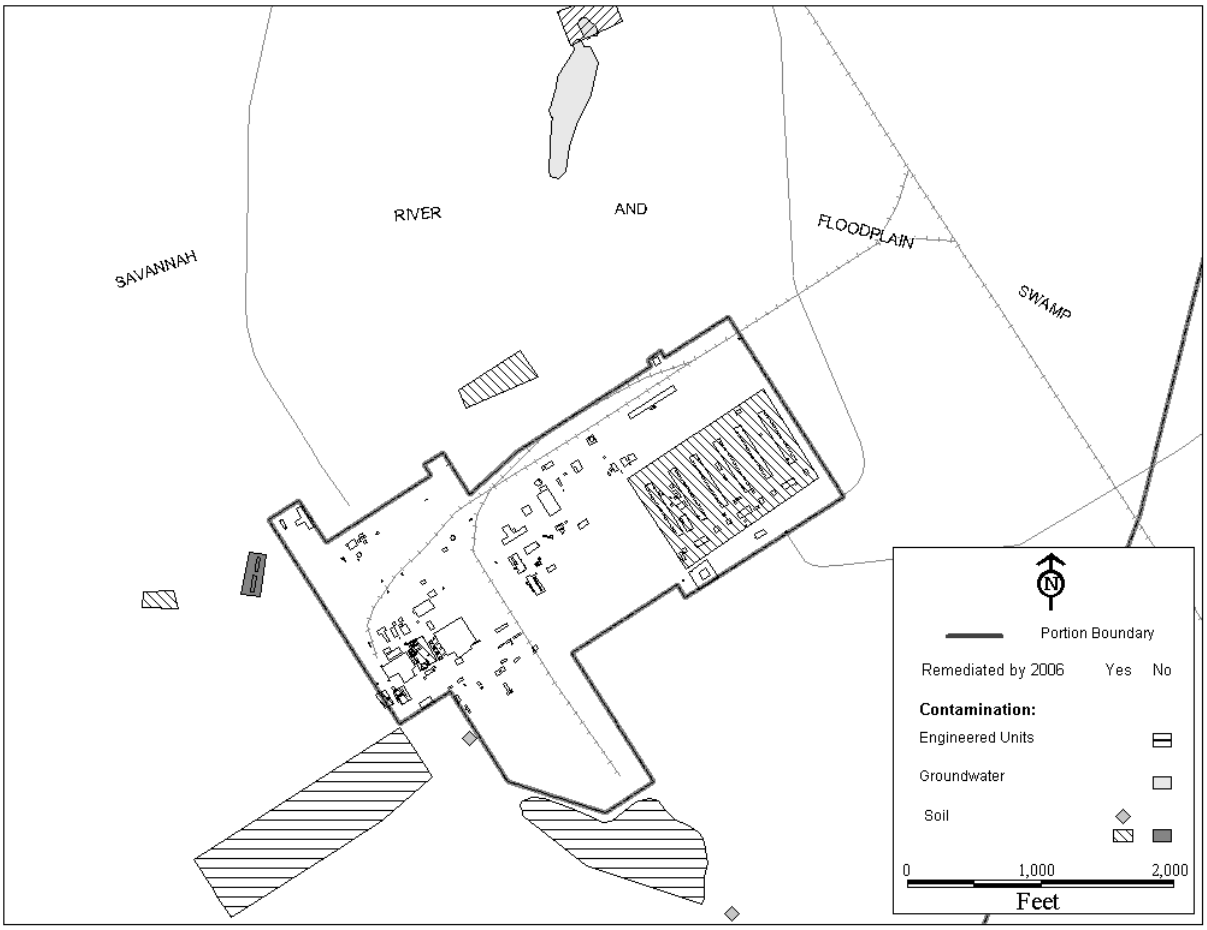
D AREA HEAVY WATER FACILITIES PORTION HIGHLIGHTS

Major Long-Term Stewardship Activities - access restrictions; long-term surveillance and maintenance
Portion Size - 7,714 square meters (83,000 square feet)
Estimated Volume of Residual Contaminants - to be determined
Long-Term Stewardship Start-End Years - 2004-indefinitely
Average Annual Long-Term Stewardship Costs FY2004-2006 - $287,495

There are no current plans for the decommissioning of the facilities. Hazards will be re-evaluated after deactivation and surveillance and monitoring programs are implemented. It is assumed that long-term monitoring will be indefinite. Long-term stewardship is assumed to begin in 2004 and continue indefinitely (for purpose of this report, through 2070).

3.2.1 Facilities

The D-Area Heavy Water Facility consists of 28 buildings and structures, which are of typical "Other Industrial" construction. The majority of the buildings are of metal or wood frame, with corrugated metal and/or transite sheathing. Most of the excess buildings (which, at this time, include the Moderator Processing and Storage



D Area Heavy Water Facilities

Buildings, Administrative Buildings, and a number of abandoned systems and structures) do not contain radiological contamination and are potential candidates for future decommissioning.

3.2.2 Long-Term Stewardship Activities

The facility is located within the fenced boundaries of SRS. Current Site plans include the retention of Site boundaries and access controls. All relevant environmental monitoring programs are assumed to continue. A periodic (annual) surveillance and maintenance program will be instituted to monitor any degradation of the building structure. Surveillance and maintenance requirements are minimal.

The containment of residual contamination is based upon the integrity of the containment structure and the ability to maintain control of water, animal, and/or human intrusion. No other engineering controls are currently planned for this facility.

3.2.3 Estimated Long-Term Stewardship Costs for the D-Area Heavy Water Facilities

The table below provides the estimated long-term stewardship costs for the D-Area Heavy Water Facilities. Costs include institutional controls, long-term surveillance and maintenance, and environmental monitoring of

the facility. Due to the potential for long-term structural degradation, there may be additional costs not currently included in the estimate.

D-Area Heavy Water Facilities							
FY 2000 - FY 2010	***FY 2011 - FY 2020***	***FY 2021 - FY 2030***	***FY 2031 - FY 2040***	***FY 2041 - FY 2050***	***FY 2051 - FY 2060***	***FY 2061 - FY 2070***	***Estimated Total***
$988,000	$333,000	$541,000	$882,000	$1,436,000	$2,340,000	$3,811,000	$10,330,000

3.3 Heavy Water Component Test Reactor (HWCTR)

HEAVY WATER COMPONENT TEST REACTOR PORTION HIGHLIGHTS

Major Long-Term Stewardship Activities - access restrictions; long-term surveillance and maintenance
Portion Size - 929 square meters (10,000 square feet)
Estimated Volume of Residual Contaminants - to be determined
Long-Term Stewardship Start-End Years - 2007-indefinitely
Average Annual Long-Term Stewardship Costs FY2000-2006 - n/a

The Heavy Water Component Test Reactor (HWCTR) terminated operations in December 1964, and all fuel and heavy water were removed from the reactor complex. A decision to retire the reactor was made in 1965, and facility systems were shut down and the facility secured by 1971. During the 1990s, the facility was evaluated and contamination areas were reduced. Demolition of non-radiological contaminated facilities resulted in reduced surveillance and maintenance costs. In early 1997, a decision was made to complete the demolition of the facility as the end-state condition. This was agreed to and supported by the stakeholders. However, budget shortfalls resulted in a decision to defer decommissioning, and activities were initiated to place the facility in a state of long-term passive storage.

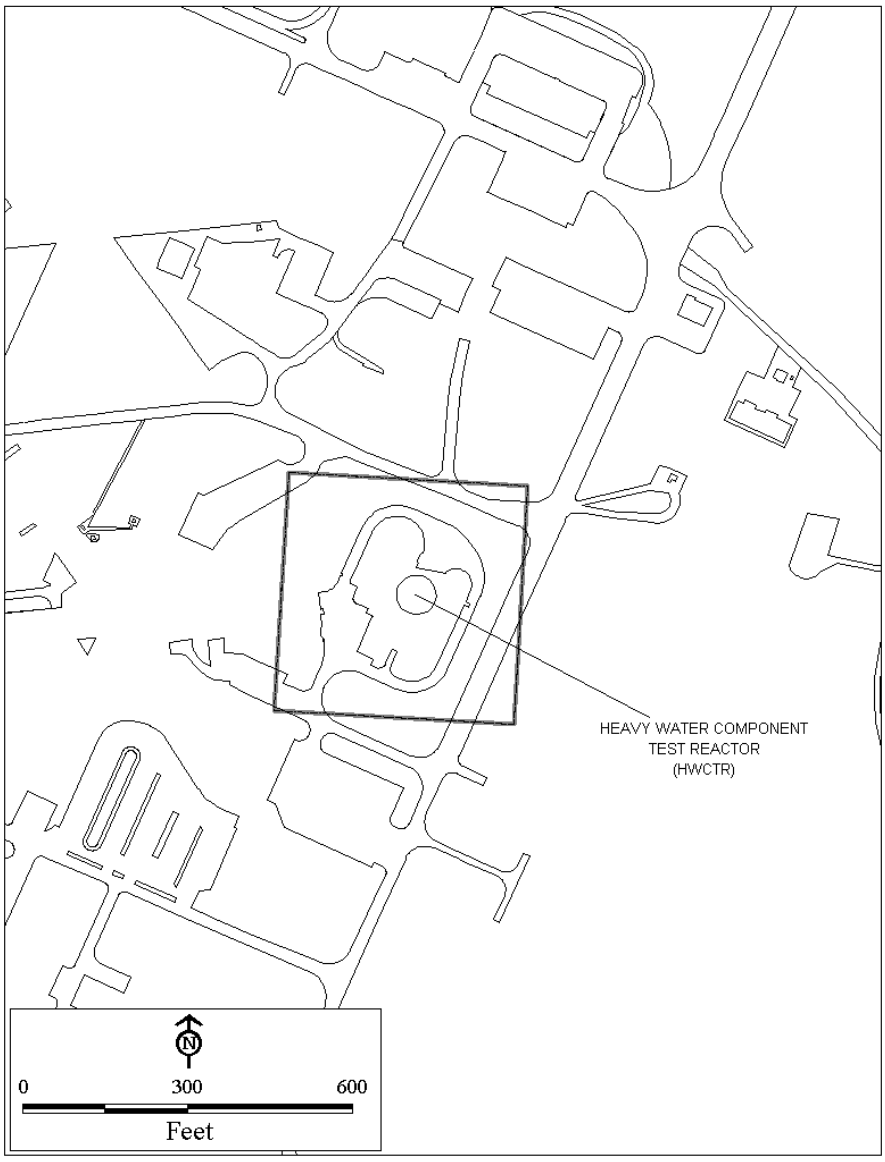
Residual radiological contamination from the operation of the test reactor remains within the reactor containment building. The total radioactive material quantity has been estimated at 2,850 curies, with the major constituents being cobalt-60, strontium-90, and cesium-137. Residual hazards and associated risks were reduced through deactivation of the facility. A low-cost surveillance and maintenance program, consisting of periodic monitoring and radiological surveys, will be conducted until a final disposition decision has been made.

3.3.1 Facilities

There is only one remaining building -- the test reactor containment building. All ancillary facilities have been decommissioned to grade. The reactor facility has been deactivated, although the containment structure has been sealed. The remaining structural envelope for the HWCTR is primarily an above-ground steel structure consisting of a dome and below-ground concrete retaining walls and foundation, comprising 930 square meters (10,000 square feet). Based upon recent evaluations and inspections, the interior concrete walls and foundation and the steel dome are in excellent condition.

3.3.2 Long-Term Stewardship Activities

The facility is located within the fenced boundaries of SRS on two acres. The building is classified as an Other Industrial Facility based upon a recent Hazards Assessment. Current Site plans include the retention of Site boundaries and access controls. All relevant environmental monitoring programs are assumed to continue. A



Heavy Water Component Test Reactor

surveillance and maintenance program will be instituted to monitor any degradation of the building structure. Long-term stewardship activities will continue indefinitely.

The containment of residual contamination is based upon the integrity of the containment structure and the ability to maintain control of water, animal and/or human intrusion. No other engineered controls are currently planned for this facility.

3.3.3 Estimated Long-Term Stewardship Costs for the Heavy Water Component Test Reactor

The table below provides the estimated long-term stewardship costs for the HWCTR. The cost estimate for long-term stewardship is based on an annual surveillance and maintenance program, starting in FY 2000 and continuing indefinitely (for purposes of this report, costs are estimated through FY 2070). Due to the potential for long-term structural degradation, there may be additional costs not currently included in the estimate.

HWCTR Portion ***Long-Term Stewardship Costs (Constant Year 2000 Dollars)***							
FY 2000 - FY 2010	***FY 2011 – FY 2020***	***FY 2021 - FY 2030***	***FY 2031 – FY 2040***	***FY 2041 – FY 2050***	***FY 2051 – FY 2060***	***FY 2061 FY 2070***	***Estimated Total***
$78,000	$208,000	$337,000	$550,000	$896,000	$1,459,00	$2,376,000	$5,904,000

3.4 247-F Naval Fuel Manufacturing Facility

247-F NAVAL FUEL MANUFACTURING FACILITY PORTION HIGHLIGHTS

Major Long-Term Stewardship Activities - access restrictions; long-term surveillance and maintenance
Portion Size - 10,827 square meters (116,508 square feet)
Estimated Volume of Residual Contaminants - to be determined
Long-Term Stewardship Start-End Years - 1997-indefinitely
Average Annual Long-Term Stewardship Costs FY2000-2006 - $261,504

The 247-F Naval Fuel Manufacturing Facility is located within a deactivated security zone in the F Area, which is one of the chemical separations and processing areas at SRS. The manufacturing facility and nearby ancillary facilities were utilized for fabrication of enriched uranium fuel for use in the production of naval reactor fuel elements, until the operation was shut down in 1988. Currently, there is no identified mission for the facility.

After the process was shut down, the 247-F Naval Fuel Manufacturing Facility was de-inventoried of enriched uranium and chemicals, and the process equipment was flushed and isolated; however, portions of the building and equipment are contaminated with corrosive residue, containing a measurable quantity of enriched uranium. The facility was deactivated in the mid-1990s. There are currently no final decisions to the final end state of this facility. Although there is no planned re-use for this facility, there are currently no plans for its decommissioning. The facility is currently in a state of long-term passive storage. Residual hazards and associated risks were reduced through deactivation, and DOE maintains the facilities in a low-cost surveillance and maintenance program until a final disposition decision is made.

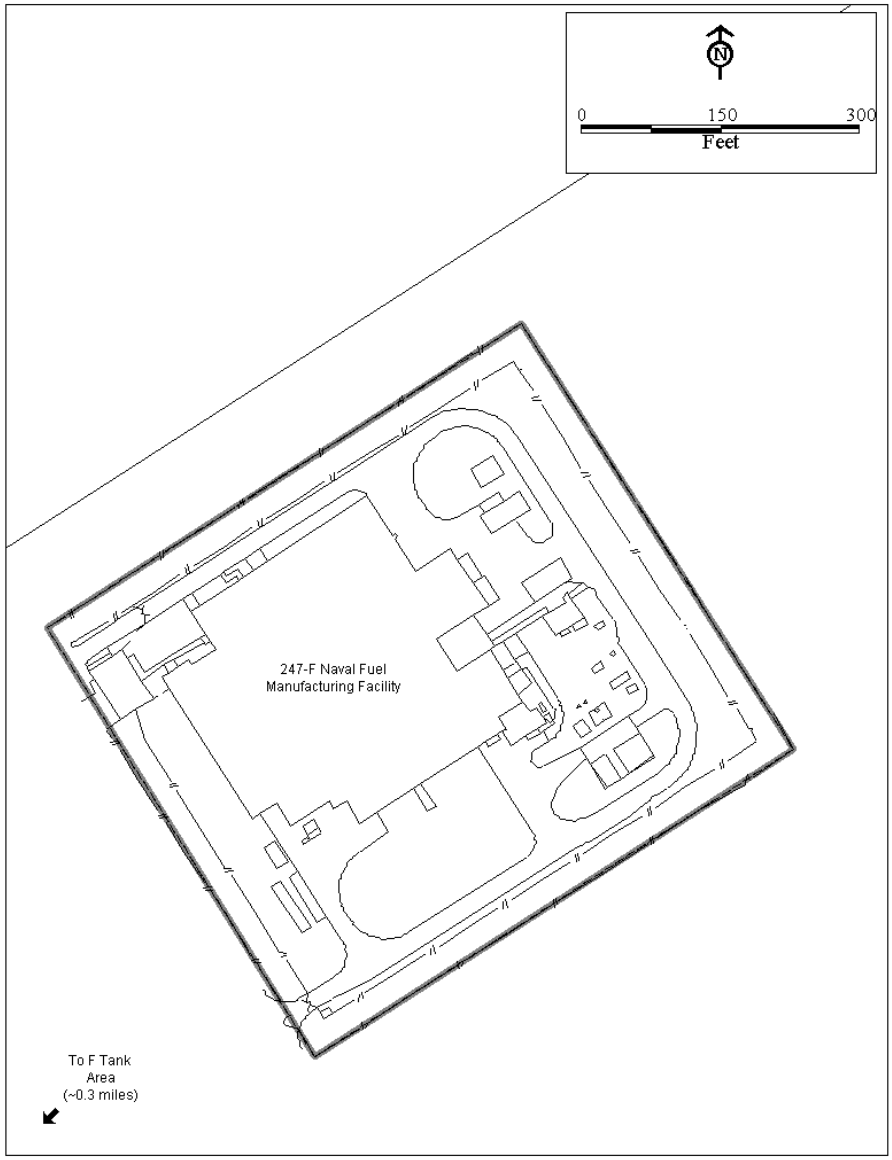
3.4.1 Facilities

The manufacturing building and ancillary structures are made up primarily of steel frame and comprise an area of 10,827 square meters (116,508 square feet). Residual radiological contamination (enriched uranium) from the operation of the manufacturing facility remains within the equipment and systems within the process area.

3.4.2 Long-Term Stewardship Activities

The facility is located within the fenced boundaries of the F Area at SRS. The facility has been reclassified as a Radiological facility based upon a recent Hazards Assessment. A Radiological facility requires continued surveillance and maintenance appropriate to existing hazards and facility condition. Current Site plans include

the retention of F Area and Site boundaries and appropriate access controls. All relevant environmental monitoring programs are assumed to continue.



247-F Naval Fuel Manufacturing Facility

The containment of residual contamination is based upon the integrity of the structure, gloveboxes and other engineered containment. Spread of residual contamination is controlled through the ability to maintain control of water, animal and/or human intrusion. A periodic surveillance and maintenance program is instituted to monitor any degradation of the building structure and or conditions and ensure no impact upon worker, public or environmental safety. No other engineering controls are currently planned for this facility.

Long-term stewardship for this facility began in 1997 and, because no final decision has been made about decommissioning the facility, is anticipated to continue indefinitely (for purposes of this report, costs are estimated through 2070).

3.4.3 Estimated Long-Term Stewardship Costs for the 247-F Naval Fuel Manufacturing Facility

The table below provides the estimated long-term stewardship costs for the 247-F Naval Fuel Manufacturing Facility, starting in FY2000 and continuing through FY2070. Cost estimates are based on a low-cost surveillance and maintenance program. Due to the potential for long-term structural degradation, there may be additional costs not currently included in the estimate.

247-F Naval Fuel Manufacturing Facility Long-Term Stewardship Costs (Constant Year 2000 Dollars)							
FY 2000 - FY 2010	***FY 2011 - FY 2020***	***FY 2021 - FY 2030***	***FY 2031 – FY 2040***	***FY 2041 - FY 2050***	***FY 2051- FY2060***	***FY 2061 - FY 2070***	***Estimated Total***
$2,242,000	$1,465,000	$2,386,000	$3,886,000	$6,331,000	$10,312,000	$16,797,000	$43,419,000

3.5 M Area - Fuel/Target Fabrication Facilities

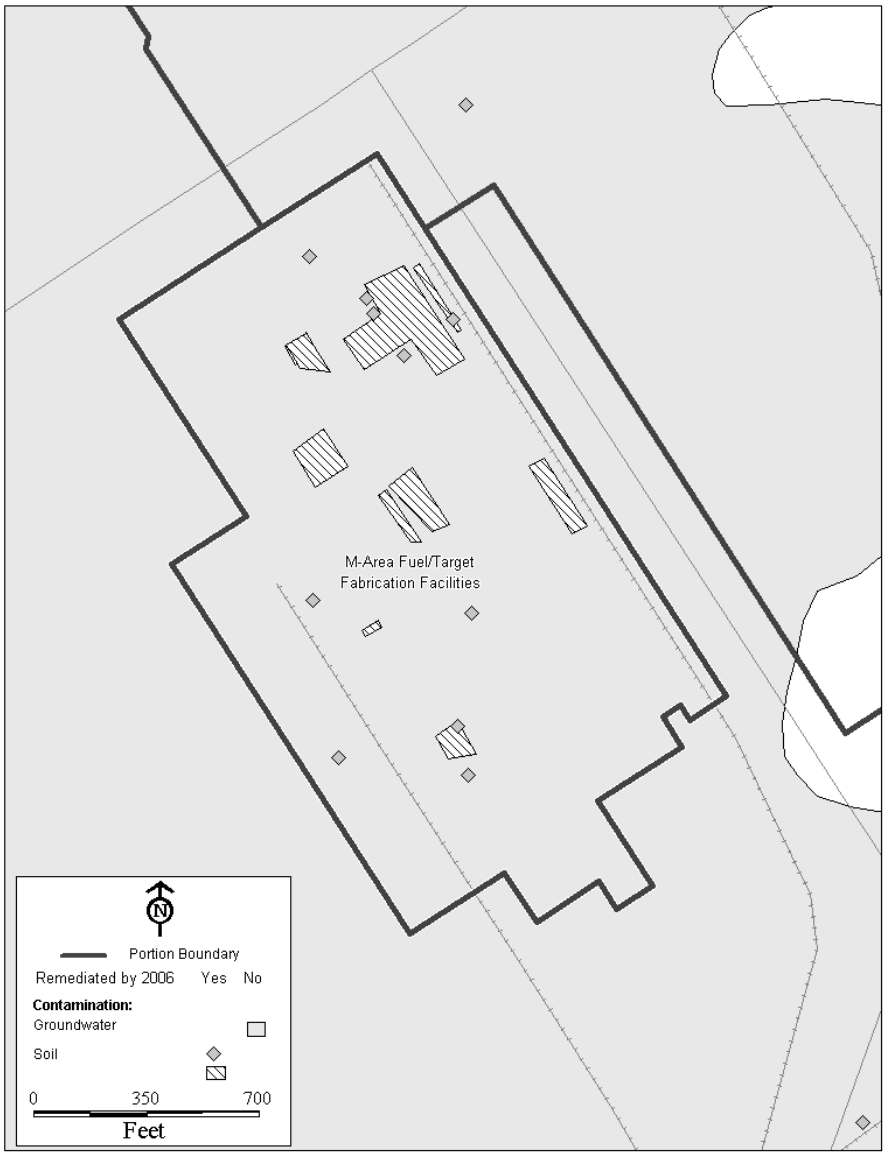
M AREA FUEL/TARGET MANUFACTURING FACILITIES PORTION HIGHLIGHTS

Major Long-Term Stewardship Activities - access restrictions; long-term surveillance and maintenance
Portion Size - 39,151 square meters (421,270 square feet)
Estimated Volume of Residual Contaminants - to be determined
Long-Term Stewardship Start-End Years - 1997-indefinitely
Average Annual Long-Term Stewardship Costs FY2000-2006 - N/A

The M Area is located in the northeast portion of SRS, close to the Site border. The fenced area contains the Fuel/Target Manufacturing facilities. These facilities were designed for machine fabrication of special fuel assemblies that contained targets used in the production of special nuclear materials and were also used as safe storage for the assemblies prior to use in the reactor areas. These facilities were used to stabilize existing stockpiles by consolidating (melting) fabricated assemblies into ingots, which have since been stored in another facility until the Oak Ridge Reservation can receive them. No longer required to support a Site mission, the facilities were systematically shut down during the 1990s and are currently being deactivated. There are currently no final decisions as to the final end state of these facilities, and there are no near-term plans to decommission the buildings.

3.5.1 Facilities

The manufacturing building and ancillary structures are made up primarily of steel frame and comprise an area of 39,151 square meters (421,270 square feet). The several buildings are contaminated with residual uranium and other hazardous material contaminants. The hazard classification of these facilities includes Industrial, Contaminated, and Nuclear, based upon a recent Hazards Assessment. Upon deactivation, these hazard classifications may significantly change. Although there is residual contamination from operation of the facilities, the volume of residual contamination will not be known until deactivation activities are completed, which will be prior to 2006. Once deactivation is completed, the facilities will remain in a long-term passive status until end-state decisions are made.



M Area Fuel/Target Fabrication Facilities

3.5.2 Long-Term Stewardship Activities

The Fuel/Target Fabrication facilities are located within the fenced boundaries of the M Area at SRS. Current Site plans include the retention of M-Area boundaries and appropriate access controls. The containment of residual contamination is based upon the integrity of the structures. Spread of residual contamination is controlled through the ability to maintain control of water, animal, and/or human intrusion. Continuation of periodic surveillance and maintenance will be required to monitor any degradation of the existing building structures and/or conditions and ensure no impact upon workers, the public, and the environment. No other engineering controls are currently planned for these facilities. The surveillance and maintenance program is assumed to begin in 2007 and continue indefinitely (for purposes of this report, costs are estimated through 2070).

3.5.3 Estimated Long-Term Stewardship Costs for the M-Area Fuel/Target Fabrication Facilities

The table below provides the estimated long-term stewardship costs for the M-Area Fuel/Target Fabrication facilities, starting in FY 2007 and continuing through FY 2070. Cost estimates for long-term stewardship are based on a low-cost surveillance and maintenance program. Due to the potential for long-term structural degradation, there may be additional costs not currently included in the estimate.

M-Area Fuel/Target Fabrication Facilities Long-Term Stewardship Costs (Constant Year 2000 Dollars)							
FY 2000 - FY 2010	***FY 2011 - FY 2020***	***FY 2021 - FY 2030***	***FY 2031 - FY 2040***	***FY 2041 - FY 2050***	***FY 2051 - FY 2060***	***FY 2061 - FY 2070***	***Estimated Total***
$2,685,00	$9,565,00	$15,580,00	$25,378,00	$41,339,00	$67,337,00	$109,684,00	$271,569,00

3.6 Upper Three Runs Watershed Portion

The Upper Three Runs watershed contains 818 contaminated hectares (2,023 contaminated acres) that will be in long-term stewardship by 2006. The watershed is in the northernmost area of SRS (about 22 kilometers long by 16 kilometers wide - or about 14 miles long by 10 miles wide) and encompasses several operational areas of SRS -- A/M, F, H, and part of E. This portion contains soil and groundwater contamination as a result of practices used to manage environmental restoration wastes, high-level waste, and facilities deactivation.

UPPER THREE RUNS WATERSHED PORTION HIGHLIGHTS

Major Long-Term Stewardship Activities - well monitoring; operation/maintenance of treatment facilities; maintenance of institutional and engineered controls; and compliance support
Portion Size - 818 hectares (2,023 acres)
Estimated Volume of Residual Contaminants - to be determined
Long-Term Stewardship Start-End Years - 1996-in perpetuity
Average Annual Long-Term Stewardship Costs FY2000-2006 - $10,856,714

The operational areas covered by this report and their respective units (environmental restoration waste, high-level waste, and facilities deactivation) are as follows:

A/M Areas

- SRL Seepage Basins, which contain low-level waste (cesium, strontium);
- A-Area Rubble Pile, which contains soil contaminated with low level PCBs, VOCs and lead;
- A-Area Burning/Rubble Pits, which contain soil contaminated with sanitary waste and groundwater contaminated with low levels of VOC; and
- M-Area Hazardous Waste Management Facility - Vadose Zone, which contains hazardous waste and has groundwater possibly contaminated with chlorinated VOCs

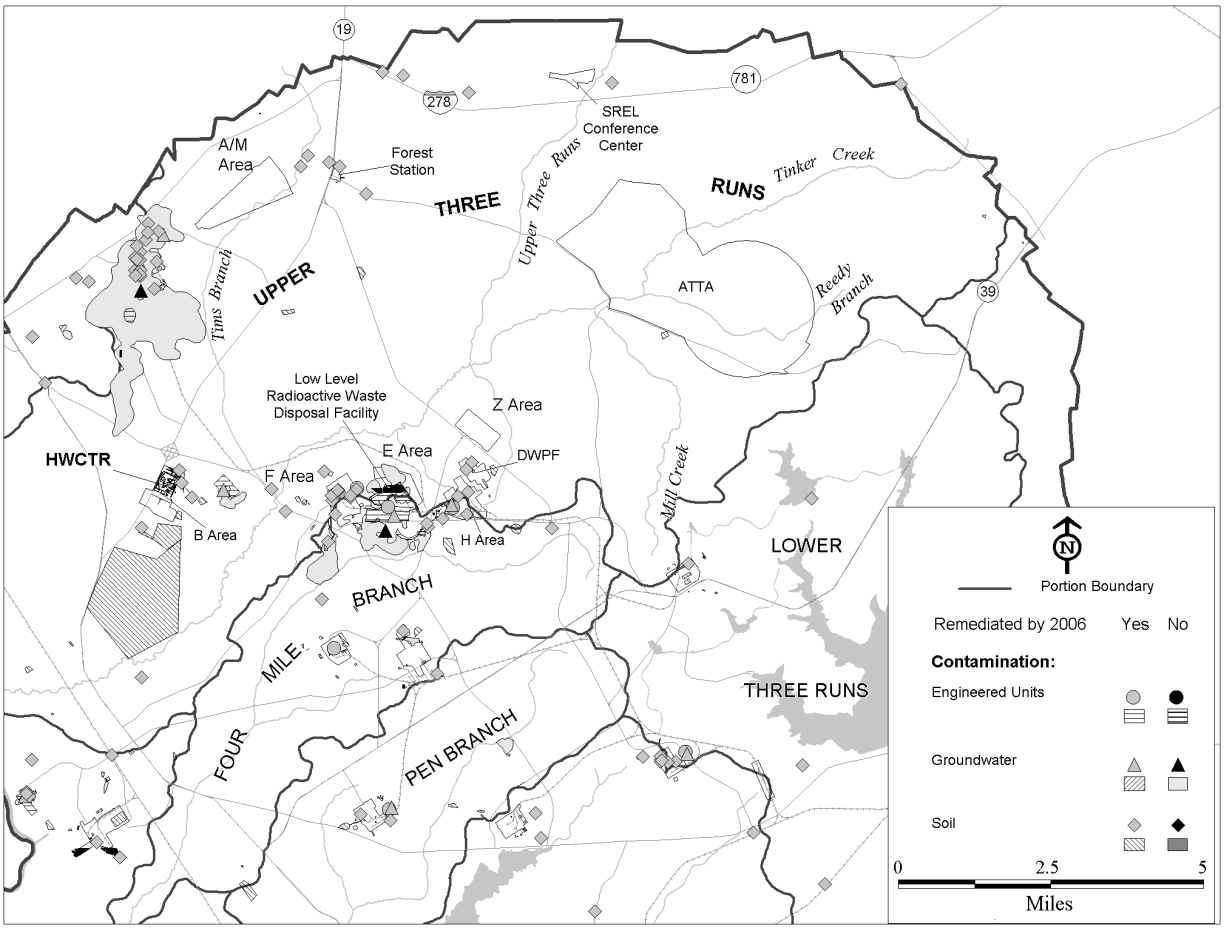
F/H Area

- F-Area Burning/Rubble Pits, which contain contaminated soils
- F-Area Retention Basin, which contains soil contaminated with low-level mixed waste
- Low-Level Radioactive Disposal Facility
- Old F-Area Seepage Basin, which contains soils contaminated with low-level mixed waste
- F&H-Area Hazardous Waste Management Facilities (Groundwater)

Units Not in a Specific Area

- Metallurgical Laboratory Groundwater, which is contaminated with chlorinated VOCs.
- Mixed Waste Management Facility, which contains low-level radioactive waste

Further details on these units are provided in the sections below as they relate to the remediation of the specific contaminated media -- soil, engineered units, and groundwater. A discussion of long-term stewardship for this portion follows the detailed media discussions.



Upper Three Runs

3.6.1 Soil

Soils in the Upper Three Runs are contaminated with VOCs, metals, radionuclides, and semi-volatile compounds. Following the final CERCLA Record of Decision for the Upper Three Runs, it is anticipated that residual VOCs, metals, and radionuclide contamination will exist in the soils in some areas. Some contaminated basins have been previously closed with waste remaining in place. Remedial actions on the source units (soils) will focus on excavation/removal of highly contaminated soils and barrier/containment type technologies that prevent exposure to contamination and that minimize and contain the spread of contamination. The final action for the F-Area Burning/Rubble Pits is institutional controls.

At this time, the volume of residual contamination for the soil cannot be estimated due to the fact that the area is still under investigation, and the extent of contamination is still being defined.

3.6.2 Engineered Units

The engineered units in the Upper Three Runs portion are contained in the F and H Areas. The F-Area Retention Basin contains low-level mixed waste. Proposed methods of remediation include chemical stabilization and grouting. The Old F-Area Seepage Basin is an unlined seepage basin that received low-level radioactive wastewater from F-Area chemical separations until 1969. Soils are contaminated with low-level mixed waste. Stabilization with grouting was completed, and a cover has been installed.

The Low-Level Radioactive Waste Disposal Facility (LLRWDF), a 48-hectare (119-acre) solid waste landfill for radioactively contaminated waste, contains buried contaminated job-control waste and process-equipment waste generated from SRS and offsite operations. The LLRWDF contains two main types of trenches:

- Slit trenches, which are earthen trenches, typically six meters deep by six meters wide (20 feet deep by 20 feet wide) and varying in length. They receive minimally containerized wastes.
- Engineering Low-Level Trenches (ELLTs), which are larger trenches that receive wastes packaged in metal boxes (called B-25 boxes), usually 1.2 meter by 1.2 meter (four feet by four feet). These boxes are stacked four high in a stair-step fashion.

REMEDIATION STRATEGY FOR THE UPPER THREE RUNS WATERSHED PORTION

- Stabilize and remediate sources of contaminants at the waste units.
- Optimize remediation of groundwater plume.
- Install remediation equipment or plan installation during next two years to approach plume control in A/M Areas.
- Drive down costs and remediation time using new technologies.
- Address major issues impacting final closure schedule for A/M Groundwater:
  - Effective technologies needed to locate all Dense Non-Aqueous Phase Liquid (DNAPL) pools for remediation.
  - Negotiation of alternate maximum concentration levels (MCLs) that take credit for natural attenuation
- Aggressively pursue new DNAPL characterization and remediation technologies to greatly reduce remediation time and costs.
- Use multidisciplinary team formed to research natural attenuation basin/benefits/status.

The LLRWDF has been receiving wastes since 1972. In 1990, a RCRA closure of the trenches used between 1972 and March 1986 was completed. This closure involved the covering of the 23 hectares (58 acres) of the facility with a 0.9-meter (three-foot) kaolin clay cap. Another planned closure will close the trenches suspected of receiving RCRA F-listed solvent contaminated rags between March 1986 and January 1990. 5.3 hectares (13 acres) of trenches are required to be closed, but the entire trench closure will be about 9.7 hectares (24 acres) due to the close proximity of trenches used after January 1990. The closure plan has been approved by SCDHEC and stipulates that this closure use a composite cap consisting of a geosynthetic clay liner and a flexible membrane liner.

3.6.3 Groundwater

Contaminated groundwater in the Upper Three Runs portion is located in the A/M Areas, F and H Areas, and in the other smaller general areas. The contaminant is primarily VOCs. Dense non-aqueous phase liquids (DNAPLs) are also present and pose a significant challenge for remediation. DNAPLs are concentrated areas of organic solvent contamination in the vadose zone or in low places in the groundwater aquifer. Technology development efforts have been focused on identifying better ways to find and remediate regions of DNAPL

contamination. Currently, much of the VOC plume is undergoing some remediation. It is anticipated that residual VOCs will remain in the groundwater. Proposed remedial actions include in situ remediation techniques (air sparging, vapor extraction, bioremediation, etc.) and monitored natural attenuation.

At this time, the volume of residual contamination for the groundwater cannot be estimated. This is because the area is still under investigation and the extent of contamination is still being defined. Cleanup goals for groundwater will be set at maximum concentration levels (MCLs). MCLs are the ultimate cleanup goal as set forth by state policy. Cleanup of the groundwater will be achieved through monitored natural attenuation.

3.6.4 Long-Term Stewardship Activities

The A and M Areas are located in the Site's Industrial Support Zone, adjacent to the Restricted Public Use Zone. The E, F, and H Areas are located in the Industrial Zone. Subject to specific site development restrictions, the Industrial Support Zone will allow waste management activities, and the Industrial Zone will allow both waste management and industrial uses. The SRS boundary will restrict public access. Institutional controls will be used to prevent residential use, excavation of buried/stabilized wastes, and inappropriate use of the groundwater.

At this time, the volume of residual contamination for the groundwater and soil cannot be estimated. This is because the area is still under investigation. The extent of contamination is still being defined. Target cleanup levels for groundwater will be set at MCLs. However, groundwater will be allowed to reach MCL levels through monitored natural attenuation. Due to the proximity to the populated Site boundary, some areas may be considered for residential cleanup levels.

DOE anticipates that DOE/EM remediation activities and long-term surveillance and maintenance activities (for the operational phase) of the Upper Three Runs portion will be completed by 2042. Periodic monitoring and institutional controls will be implemented and deed restrictions will be required in the event that the property is transferred to other ownership.

3.6.5 Estimated Long-Term Stewardship Costs for the Upper Three Runs Watershed Portion

The table below provides the estimated cost for the operating phase of long-term stewardship for the Upper Three Runs portion for areas completed by the end of FY 2006. The cost estimate includes costs for well monitoring, operation and maintenance of treatment facilities, and maintenance of institutional and engineered controls, along with compliance support.

Upper Three Runs Watershed Portion Long-Term Stewardship Costs (Constant Year 2000 Dollars)							
FY 2000 - FY 2010	***FY 2011 - FY 2020***	***FY 2021 – FY 2030***	***FY 2031 – FY 2040***	***FY 2041 - FY 2050***	***FY 2051 - FY 2060***	***FY 2061 – FY 2070***	***Estimated Total***
$89,764,000	$16,042,000	$3,462,000	$0	$0	$0	$0	$109,268,000

The confidence level for the cost estimate is high based on conditions and agreements within the latest approved Federal Facility Agreement and applicable permits, agreements, consent orders, laws, and regulations. However, DOE acknowledges that milestones could change based on future negotiations with regulators as new work scope is identified.

3.7 Lower Three Runs Watershed Portion

The Lower Three Runs watershed contains 44 contaminated hectares (110 contaminated acres) that will be in long-term stewardship by 2006. The watershed is in the southeastern area of SRS (about 9.6 kilometers long by 16 kilometers wide - or about six miles long by ten miles wide) and encompasses several operational areas of the Site -- the P and R Areas. Release sites at the reactor areas were used for the disposal of radioactive and chemical wastes. Contamination in this portion consists of low-level radioactive waste, hazardous waste, and toxic metals as the result of practices used to dispose of chemical and radioactive wastes.

LOWER THREE RUNS WATERSHED PORTION HIGHLIGHTS

Major Long-Term Stewardship Activities - well monitoring; operation/maintenance of treatment facilities; maintenance of institutional and engineered controls; and compliance support
Portion Size - 44 hectares (110 acres)
Estimated Volume of Residual Contaminants - to be determined
Long-Term Stewardship Start-End Years - 1997-in perpetuity
Average Annual Long-Term Stewardship Costs FY2000-2006 - $439,857

The specific waste units covered by this section of the report are as follows:

P Area

- P-Area Bingham Pump Outage Pits, which contain low-level radioactive waste

R Area

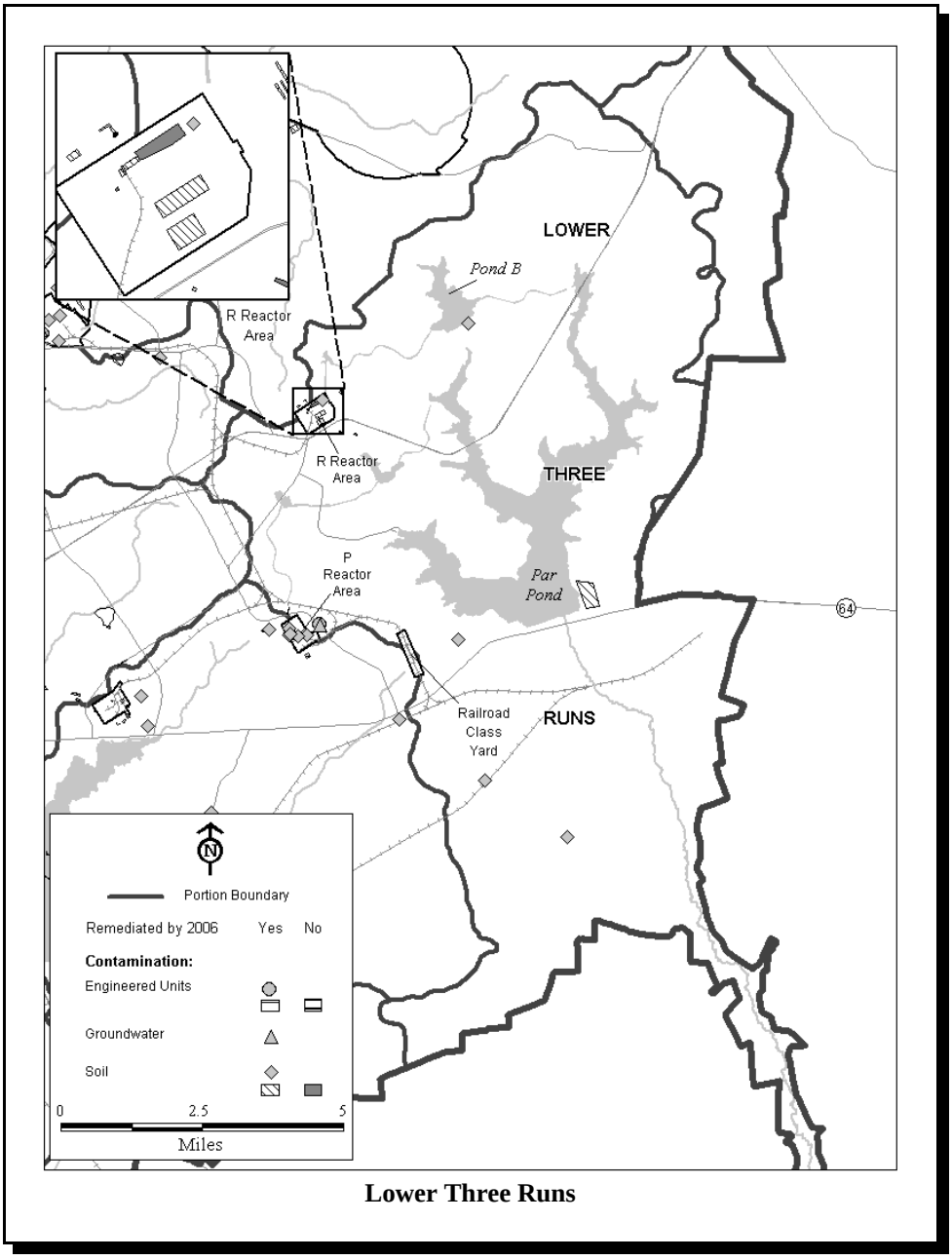
- R-Area Acid/Caustic Basin, which contains toxic metals
- R-Area Burning/Rubble Pit and Rubble Pit, which contains hazardous waste
- R-Area Reactor Seepage Basins

A more detailed discussion of the contamination, by soil and by engineered units, is provided in the sub-sections below. A discussion of long-term stewardship for the Lower Three Runs portion follows.

3.7.1 Soil

Soils in the Lower Three Runs are contaminated with VOCs, metals, tritium, other radionuclides and unknowns. At this time, the volume of residual contamination for soil cannot be estimated. This is because the area is still under investigation and the extent of contamination is still being defined. Cleanup goals for the soils will be set at levels protective of industrial workers and researchers and will be protective of the groundwater to the maximum extent practicable.

Following the final CERCLA Record of Decision for the Lower Three Runs, it is anticipated that residual VOCs, metals, and radionuclide contamination will exist in the soils in some areas. The Lower Three Runs includes radioactive seepage basins, such as the R-Area Reactor Seepage Basins, that received radionuclide materials. These types of waste units will be closed in situ without removing the contamination. Remedial actions on the source units (soils) will focus on barrier/containment type technologies that prevent exposure to contamination and minimize/contain the spread of contamination. In situ soil vapor extraction and air sparging may be used to remove VOC contaminants from the vadose zone. More detail on specific units is provided below.



Lower Three Runs

The R-Area Burning/Rubble Pit, which contains hazardous waste, was closed in 1981. The proposed onsite treatment for the contaminated soils in the R-Area Burning/Rubble Pit is thermal disorption.

The Par Pond Sludge Lagoon received sludge from the Central Shops (N-Area) Sludge Lagoon. The sediment in Par Pond is contaminated with radionuclides and metals. At this time, no active remedial actions are anticipated for the sediments.

For the R-Area Acid/Caustic Basin, capping in place is the proposed remediation. For the P-Bingham Pump Outage, the proposed remediation method is access/institutional controls only.

3.7.2 Engineered Units

The P-Area Bingham Pump Outage Pits contain a series of unlined earthen pits located outside the fences of reactor areas K (one pit), L (two pits), P (one pit), and R (three pits). These pits received low-level radioactive construction debris generated during the 1957 and 1958 repairs to the primary and secondary cooling water systems (known as the "Bingham Pump Outages") in the reactor areas. All pits were backfilled and do not contain pumps. The contaminants of concern are radionuclides and metals. As part of the "Approved Standardized Corrective Action Design" (ASCAD) approach being applied to the Bingham Pump Outage Pits, DOE has determined that the Bingham Pump Outage Pits in the K, L, and P areas are "no action" sites, and institutional controls will be put in place. The R-Area Bingham Pump Outage Pits have been dropped from the ASCAD group due to low level VOC concentrations found in the groundwater and are proceeding on a separate regulatory path and schedule. The R-Area Acid/Caustic Basin is still being assessed (assessment forecasted for completion in 2003).

3.7.3 Long-Term Stewardship Activities

The Lower Three Runs watershed is located within the Site's Industrial and Industrial Support Zones. As appropriate for the specific zone, anticipated end states may allow for nuclear, heavy and light industry, industry support, and research and development. Institutional controls will be implemented to prevent residential use and excavation of buried/stabilized wastes and inappropriate use of the groundwater.

DOE anticipates that DOE/EM remediation activities and long-term surveillance and maintenance activities (for the operational phase) for remediated release sites of the Lower Three Runs portion will be completed by 2038. Periodic monitoring and institutional controls will be implemented and deed restrictions will be required in the event that the property is transferred to other ownership.

3.7.4 Estimated Long-Term Stewardship Costs for Lower Three Runs Watershed Portion

The table below provides the estimated cost for the operating phase of long-term stewardship for the Lower Three Runs portion for areas completed by the end of FY 2006. The cost estimate includes costs for well monitoring, operation and maintenance of treatment facilities, and maintenance of institutional and engineered controls, along with compliance support.

Lower Three Runs Watershed Portion Long-Term Stewardship Costs (Constant Year 2000 Dollars)							
FY 2000 - FY 2010	***FY 2011 – FY 2020***	***FY 2021 - FY 2030***	***FY 2031 - FY 2040***	***FY 2041 - FY 2050***	***FY 2051 - FY 2060***	***FY 2061 - FY 2070***	***Estimated Total***
$7,193,000	$5,918,000	$85,000	$0	$0	$0	$0	$13,196,000

The confidence level for the cost estimate is high based on conditions and agreements within the latest approved Federal Facility Agreement and applicable permits, agreements, consent orders, laws, and regulations. However, DOE acknowledges that milestones could change based on future negotiations with regulators as new work scope is identified.

3.8 Steel Creek Watershed Portion

The Steel Creek watershed contains four contaminated hectares (10 contaminated acres) that will be in long-term stewardship by 2006. The watershed is on the southern boundary SRS (about 9.6 kilometers long by 10

kilometers wide - or about 6 miles long by 6.5 miles wide) and encompasses two operational areas of SRS -- the L and P Areas -- and the L Lake. This portion contains soil and groundwater contamination as a result of practices used to dispose of wastewater and hazardous and radioactive wastes.

STEEL CREEK WATERSHED PORTION HIGHLIGHTS

Major Long-Term Stewardship Activities - well monitoring; operation/maintenance of treatment facilities; maintenance of institutional and engineered controls; and compliance support
Portion Size - 4 hectares (10 acres)
Estimated Volume of Residual Contaminants - to be determined
Long-Term Stewardship Start-End Years - 1996-in perpetuity
Average Annual Long-Term Stewardship Costs FY2005-2006 - $152,000 (no costs identified for FY2000-2004; earlier costs incurred prior to 2000)

The specific waste units covered by this report are as follows:

L Area

- L-Area Oil and Chemical Basin, which has soils containing low-level mixed waste
- L-Area Hot Shop, which has soils containing low-level radioactive and potentially mixed waste
- L-Area Reactor Seepage Basin, which has soils containing low-level radioactive waste

P Area

- P-Reactor Seepage Basin, which has soils containing low-level radioactive waste
- P-Area Burning/Rubble Pit, which has soils containing hazardous waste

A more detailed discussion of the contamination, by soil and by engineered units, is provided in the sub-sections below. A discussion of long-term stewardship for the Steel Creek portion follows.

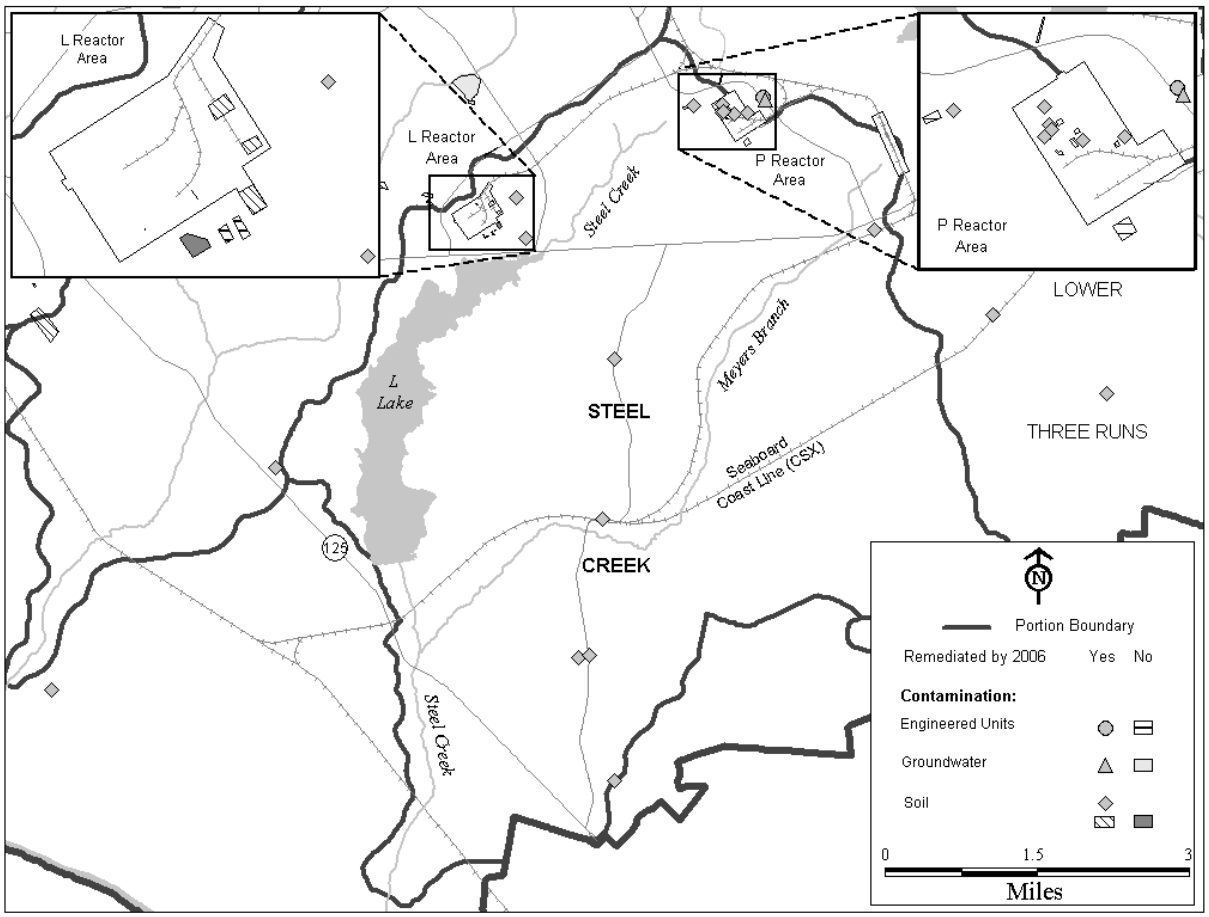
3.8.1 Soil

REMEDIATION STRATEGY FOR THE LOWER THREE RUNS AND STEEL CREEK WATERSHED PORTIONS

- Pursue Plug-In Record of Decisions for high-risk reactor seepage basins.
- Assess and remediate the area groundwater as an integral operable unit.
- Develop a technology position on tritiated groundwater.
- Assess and remediate surface operable units independent of their groundwater component when a groundwater plume is co-mingled with other plumes.
- Drive down costs and remediation funds using new technologies.

Soils in the Steel Creek are contaminated with VOCs, metals, tritium, and other radionuclides. Following a final decision for the Steel Creek, it is anticipated that residual VOC, metals, and radionuclide contamination will exist in the soils in some areas. The Steel Creek includes radioactive seepage basins that received organic and radionuclide materials. These types of waste units will be closed in situ without removing the contamination. Remedial actions will focus on barrier/containment type technologies that prevent exposure to contamination and that minimize and contain the spread of contamination. In situ soil vapor extraction and air sparging may be used to remove VOC contaminants from the vadose zone.

The L-Area Hot Shop consisted of three inter-connected buildings and one storage area, which were used in the maintenance and repair of equipment from the reactor areas. They were last used in 1983, and maintenance work has been minimal. The Hot Shop discharged decontamination wastewater, containing radionuclides, detergents, and spent degreasing solvents, through a pipeline to the L-Area Oil and Chemical Basin pipeline. The soil, rubble, and debris at the L-Area Hot Shop is contaminated with low-level radioactive and potentially mixed waste. The remediation method has not yet been determined.



Steel Creek

In all of the above cases, the volume of residual contamination in the soil cannot be estimated. This is because the area is still under investigation, and the extent of contamination is still being defined.

3.8.2 Engineered Units

The L-Area Oil and Chemical Basin also has soil and pipes contaminated with radionuclides and spent degreasing solvents from operation of the L-Area Hot Shop. Solidification/stabilization is the remediation method.

The P-Area Burning/Rubble Pit was used for the disposal of organic chemicals of unknown use and origin, waste oils, and other wastes. Soils were contaminated with these hazardous wastes from the burning/rubble pits. The proposed remediation method will involve thermal desorption.

3.8.3 Long-Term Stewardship Activities

The L and P Areas are located in the Site's Industrial Zone. Allowed uses in this zone include waste management activities. Institutional controls will be implemented where waste is left in place.

All activities in the Steel Creek watershed are restricted to the uses identified for the Industrial Zone. Anticipated end states may include nuclear, heavy and light industry, industry support, and research and development. Institutional controls will be implemented to prevent residential use and excavation of buried/stabilized wastes and inappropriate use of the groundwater. At this time, the volume of residual contamination for soils and groundwater cannot be estimated. Cleanup goals for the soils will be set at levels protective of industrial workers and researchers and will be protective of the groundwater to the maximum extent practicable. Cleanup goals for groundwater will be set at MCLs. However, groundwater will be allowed to reach MCL levels through monitored natural attenuation.

DOE anticipates that DOE/EM remediation activities and long-term surveillance and maintenance activities (for the operational phase) for remediated release sites of the Steel Creek portion will be completed by 2034. Periodic monitoring and institutional controls will be implemented and deed restrictions will be required in the event that the property is transferred to other ownership.

3.8.4 Estimated Long-Term Stewardship Costs for the Steel Creek Watershed Portion

The table below provides the estimated cost for the operating phase of long-term stewardship for the Steel Creek portion for areas completed by the end of FY 2006. The cost estimate includes costs for well monitoring, operation and maintenance of treatment facilities, and maintenance of institutional and engineered controls, along with compliance support.

Steel Creek Watershed Portion Long-Term Stewardship Costs (Constant Year 2000 Dollars)							
FY 2000 - FY 2010	***FY 2011 - FY 2020***	***FY 2021 - FY 2030***	***FY 2031 – FY 2040***	***FY 2041 - FY 2050***	***FY 2051 - FY 2060***	***FY 2061 - FY 2070***	***Estimated Total***
$834,000	$0	$0	$0	$0	$0	$0	$834,000

The confidence level for the cost estimate is high based on conditions and agreements within the latest approved Federal Facility Agreement and applicable permits, agreements, consent orders, laws, and regulations. However, DOE acknowledges that milestones could change based on future negotiations with regulators as new work scope is identified.

3.9 Pen Branch Watershed Portion

The Pen Branch watershed contains 28 hectares (69 contaminated acres) that will be in long-term stewardship by 2006. The watershed is in the central area of SRS (about 12 kilometers long and 4 kilometers wide - or 7.5 miles long and 2.5 miles wide) and encompasses the L and K Areas. This portion contains soil and groundwater contamination as a result of practices used to dispose of chemicals, metals, pesticides, organic chemicals, and contaminated wastewater. Facilities in this portion are currently being reused for the following activities: moderator storage, highly enriched uranium, and K-Material Storage Project (plutonium).

PEN BRANCH WATERSHED PORTION HIGHLIGHTS

Major Long-Term Stewardship Activities - well monitoring; operation/maintenance of treatment facilities; maintenance of institutional and engineered controls; and compliance support
Portion Size - 28 hectares (69 acres)
Estimated Volume of Residual Contaminants - to be determined
Long-Term Stewardship Start-End Years - 2001-in perpetuity
Average Annual Long-Term Stewardship Costs FY2001-2006 - $340,166

The specific waste units covered by this report are as follows:

L Area

- L-Area Burning/Rubble Pit, Rubble Pile, and Gas Cylinder Disposal Facility, which contains soils contained with hazardous materials
- Chemicals, Metals, and Pesticides Pits, which contain soils contaminated with hazardous materials

K Area

- K-Reactor Seepage Basin (forecast for assessment in 2000), which contains low-level radioactive waste
- K-Area Burning/Rubble Pit and Rubble Pile, which contains soil contaminated with hazardous waste
- Ford Building Seepage Basins, which contain low-level radioactive waste
- Bingham Pump Outage Pits, which contain buried debris contaminated with low-level radioactive waste

A more detailed discussion of the contamination, by soil, groundwater, and engineered units, is provided in the sub-sections below, followed by a discussion on long-term stewardship for this portion.

3.9.1 Soil

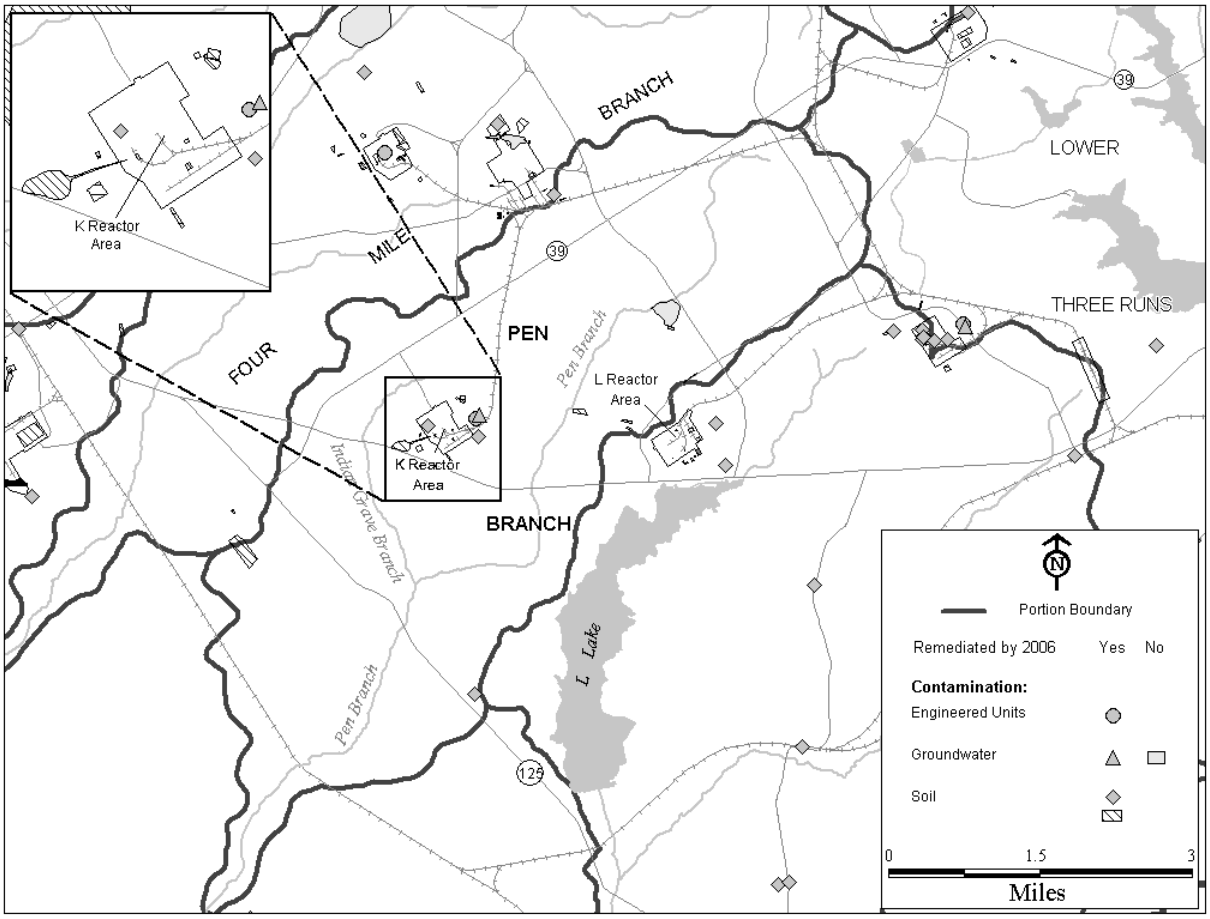
Soils in the Pen Branch are contaminated with VOCs, metals, tritium, other radionuclides, and unknowns. (Characterization of the area is ongoing - all contamination has not been identified.) Following the final decision for the Pen Branch, it is anticipated that residual VOC, metals, and radionuclide contamination will exist in the soils in some areas. The Pen Branch includes radioactive seepage basins, such as the K-Area Reactor Seepage Basin, that received radionuclide materials. These types of waste units will be closed in situ without removing the contamination. Remedial actions will focus on barrier/containment type technologies that prevent exposure to contamination and that minimize and contain the spread of contamination. In situ soil vapor extraction and air sparging may be used to remove VOC contaminants from the vadose zone.

STRATEGY FOR CONTINUED REMEDIATION SUCCESS IN THE PEN BRANCH PORTION

- Pursue Plug-In-Record of Decisions for high-risk seepage basin sites.
- Assess and remediate the groundwater as an integral operable unit.
- Develop a technology position on tritiated groundwater.
- Assess and remediate surface operable units independent of their groundwater component when a groundwater plume is co-mingled with other plumes.
- Drive down costs and remediation funds using new technologies.
- Pursue removal/treatment of PCBs and pesticides at the Chemical, Metals, and Pesticides units.
- Pursue lead and battery removal at the L-Area units.
- Pursue institutional controls at K and L-Area units.
- Pursue removal of soil piles at L-Area units and monitored natural attenuation of groundwater.
- Pursue soil cover at K-Area units and mixing zone/monitored natural attenuation.

The L-Area Burning/Rubble Pit is located about ¼ mile northwest of L Area off Road 7. Burning/Rubble Pits at SRS typically received spent organic solvents, waste oils, paper, plastics, rubber and metals, which were periodically burned. In October 1973, burning of waste was halted, but the pits continued to receive inert rubble until about 1978. They also received a large quantity of zinc-mercury and lead-acid batteries. When the Pit reached its capacity, it was backfilled with soil. The pit location is situated on fairly level terrain near the crest of the same hill occupied by L Area. Local surface drainage is toward the north to an unnamed tributary of Pen Branch.

The Chemicals, Metals, and Pesticides Pits also have soil contamination. A CERCLA investigation is underway to determine the extent of contamination to soils and groundwater. A more detailed discussion of these units is provided below.



Pen Branch

3.9.2 Groundwater

The groundwater in the Pen Branch watershed is contaminated with VOCs, tritium and potentially other contaminants (investigation not complete). Following a final decision for the groundwater, it is anticipated that residual VOCs, inorganics, and tritium will remain in the groundwater. Proposed remedial actions (to reach MCLs) include in situ remediation for VOCs and monitored natural attenuation for VOCs and tritium. The groundwater treatment strategy for this watershed, with the exception of tritium contamination, is a combination of in situ and ex situ treatment. Tritium contamination in these areas is anticipated to be remediated through natural attenuation.

The Chemicals, Metals, and Pesticides Pits were used for the disposal of wastes from 1971 to 1979. They are located about 5,200 feet north of the L-Area perimeter fence and 5,500 feet from the L-Area Burning/Rubble Pit and Rubble Pile. These units consist of seven unlined pits placed into two rows, which formerly occupied the top of a knoll about 310 feet above mean sea level. The units were 10 to 15 feet in width and between 45 and

70 feet in length. Limited records exist concerning the hazardous substances disposed at the units, but VOCs, pesticides, and metals are known to have been disposed there. In 1984, the pits were excavated, backfilled and capped, and a series of groundwater monitoring wells were installed. Thirty active monitoring wells are present in the vicinity of the units for the purpose of monitoring releases of hazardous substances from the units. Groundwater monitoring data indicate the presence of VOCs and metals in the groundwater at various wells. A soil gas survey was performed in the vicinity of the pits in 1991. Characterization of the area indicated that the soils and groundwater beneath the units contain VOCs, and surface soils adjacent to the units contain PCBs and pesticides. Remediation of the units is underway, with the installation of a system for air sparging and soil vapor extraction to treat the VOCs in the vadose zone and groundwater.

3.9.3 Engineered Units

The Ford Building Seepage Basins soils contain low-level waste. In situ remediation (capping in place) is proposed for this area.

3.9.4 Long-Term Stewardship Activities

All activities in the Pen Branch watershed are restricted to uses identified for the Site's Industrial Zone. Anticipated end states may include nuclear, heavy and light industry, industry support, and research and development. Institutional controls will be implemented to prevent residential use and excavation of buried/stabilized wastes and inappropriate use of the groundwater. At this time, the volume of residual contamination for the groundwater and soil cannot be estimated. This is because the area is still under investigation. The extent of contamination is still being defined. Cleanup goals for the soils will be set at levels protective of industrial workers and researchers and will be protective of the groundwater to the maximum extent practicable. Cleanup goals for groundwater will be set at MCLs. However, groundwater will be allowed to reach MCL levels through monitored natural attenuation.

DOE anticipates that DOE/EM remediation activities and long-term surveillance and maintenance activities (for the operational phase) for remediated release sites of the Pen Branch portion will be completed by 2032. Periodic monitoring and institutional controls will be implemented and deed restrictions will be required in the event that the property is transferred to other ownership.

3.9.5 Estimated Long-Term Stewardship Costs for the Pen Branch Watershed Portion

The table below provides the estimated cost for the operating phase of long-term stewardship for the Pen Branch portion for areas completed by the end of FY 2006. The cost estimate includes costs for well monitoring, operation and maintenance of treatment facilities, and maintenance of institutional and engineered controls, along with compliance support.

Pen Branch Watershed Portion Long-Term Stewardship Costs (Constant Year 2000 Dollars)							
FY 2000 - FY 2010	***FY 2011 - FY 2020***	***FY 2021 - FY 2030***	***FY 2031 - FY 2040***	***FY 2041 - FY 2050***	***FY 2051 - FY 2060***	***FY 2061 - FY 2070***	***Estimated Total***
3,309,000	$635,000	$300,000	$0	$0	$0	$0	$4,244,000

The confidence level for the cost estimate is high based on conditions and agreements within the latest approved Federal Facility Agreement and applicable requirements. However, DOE acknowledges that milestones could change based on future negotiations with regulators as new work scope is identified.

3.10 Four Mile Branch Watershed Portion

The Four Mile Branch watershed contains 204 contaminated hectares (504 contaminated acres) that will be in long-term stewardship by 2006. The watershed is in the northern central area of SRS (about 12.8 kilometers long by 6.5 kilometers long, or eight miles long by four miles wide) and encompasses several operational areas of the Site -- the C, and N Areas and parts of the F and H Areas. This portion contains soil and groundwater contamination as a result of practices used to dispose of hazardous and radioactive wastes. Contaminants include VOCs, metals, inorganic compounds, and radionuclides.

FOUR MILE BRANCH WATERSHED PORTION HIGHLIGHTS

Major Long-Term Stewardship Activities - well monitoring; operation/maintenance of treatment facilities; maintenance of institutional and engineered controls; and compliance support
Portion Size - 204 hectares (504 acres)
Estimated Volume of Residual Contaminants - to be determined
Long-Term Stewardship Start-End Years - 1996-in perpetuity
Average Annual Long-Term Stewardship Costs FY2001-2006 - $14,198,857

The specific waste units covered by this report are as follows:

C Area
- Coal Pile Runoff Basins, which contain contaminated soils
- C-Area Burning/Rubble Pits, which contain soils and groundwater contaminated with hazardous waste
- C-Area Reactor Seepage Basins, which are contaminated with low-level radioactive waste

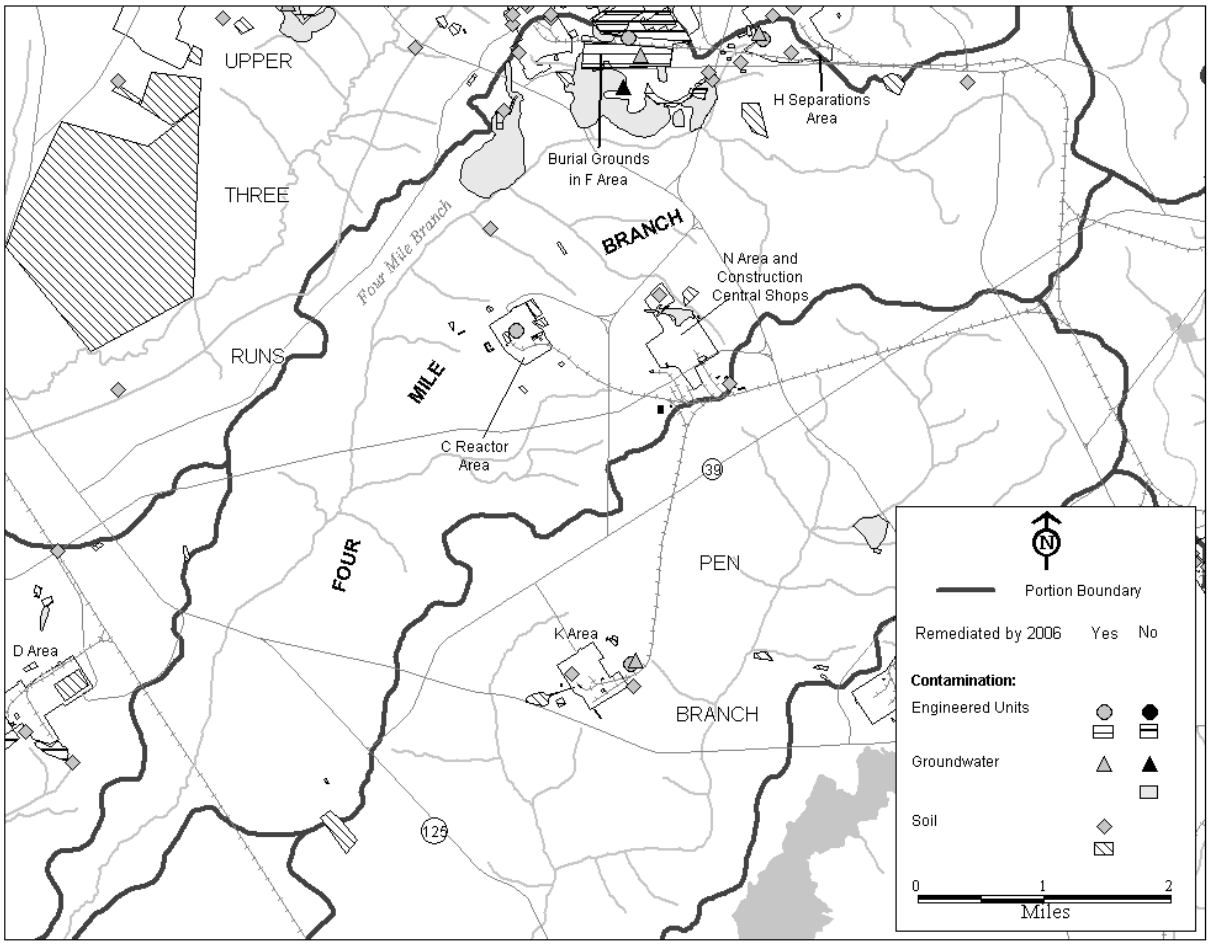
F and H Areas
- F- and H-Area Inactive Process Sewer Lines, which are contaminated with low-level radioactive waste
- H-Area Retention Basin, which contains low-level mixed waste
- Burial Ground Complex (Old Radioactive Waste Burial Ground and Low-Level Radioactive Waste Disposal Facility)
- N Area
- Soils at Central Shops Burning/Rubble Pits, which contain contaminated soils
- Soils at Central Shops Sludge Lagoon, which contains hazardous waste

A more detailed discussion of the contamination, by engineered units, soil, and groundwater, is provided below, followed by a discussion of long-term stewardship activities for this portion.

3.10.1 Engineered Units

The Burial Ground Complex is divided into a southern area and a northern area. The southern area comprises the Old Radioactive Waste Burial Ground (ORWBG). The ORWBG was the first part of the Burial Ground Complex to receive waste and was filled to capacity. Covered with a low-permeability interim cap, the engineered native soil cover reduces water infiltration by 70%. Studies will determine if this interim action proves sufficient as a final action. The northern area comprises the Low-Level Radioactive Waste Disposal Facility (LLRWDF). This area of the complex received low-level waste, which was disposed of in engineered vaults. The 58-acre Mixed Waste Management Facility (MWMF), which comprises three separate areas, closed in 1991 in accordance with RCRA regulations (i.e., covered with a conventional clay cap). However, the remaining 25 acres of the LLRWDF have been remediated using geosynthetic-capping materials.

The F- and H-Area Inactive Process Sewer Line contains contaminated soils and piping to the F- and H-Area Basin. Possible remediation includes soils mixing, grouting, and capping in place. The H-Area Retention Basin has retention basin soil with approximately 50,000 gallons of water in the basin. Chemical stabilization is the



Four Mile Branch

proposed remediation method. The remediation method has not yet been determined for the Central Shops Burning/Rubble Pits engineered unit.

3.10.2 Soil

Soils in the Four Mile Branch are contaminated with VOCs, metals, inorganic compounds, and radionuclides. Following the final decision for the Four Mile Branch, it is anticipated that residual VOC, metals, inorganic compounds and radionuclide contamination will exist in the soils. The Four Mile Branch includes the radioactive and mixed waste burial grounds and seepage basins that received inorganic, organic and radionuclide materials. Some of these source units have already been closed under RCRA and CERCLA, with waste left in place. In some cases, substantial amounts of contamination will remain in place (DOE will not dig up the burial grounds).

Remedial actions on the source units will focus on barrier/containment type technologies that prevent exposure to contamination and that minimize and contain the spread of contamination.

Possible remediation methods for the soils at the C-Area Coal Pile Runoff Basins and Burning/Rubble Pits include bioremediation/air sparging and thermal desorption. No remediation method has been chosen yet for the soils at the Central Shops Lagoon. Institutional controls will also be implemented.

3.10.3 Groundwater

The groundwater in the Four Mile Branch is contaminated with VOCs, inorganic compounds, tritium, and other radionuclides. Following the decision for the groundwater, it is anticipated that residual VOCs, inorganic compounds, and tritium will remain in the groundwater. Proposed tritium remediation includes hydraulic control and phytoremediation. Proposed remedial actions for the VOCs include in situ hot spot remediation and monitored natural attenuation (to achieve MCLs).

Possible remediation methods for the C-Area Burning/Rubble Pits groundwater [which is contaminated with trichloroethylene (TCE) and tetrachloroethylene (PCE)] include thermal desorption.

3.10.4 Long-Term Stewardship Activities

The portions discussed in this watershed are located in the Site's Industrial and Industrial Support Zones. The Burial Ground Complex has been used as disposal sites for hazardous and radioactive wastes. As such, areas have been identified that could be developed for future waste management or industrial use (to support future missions involving mixed oxide fuel and production and purification of tritium). Periodic monitoring and institutional controls will be implemented and deed restrictions will be required in the event that the property is transferred to other ownership.

At this time, the volume of residual contamination for soils and groundwater cannot be estimated. This is because the area is still under investigation, and the extent of contamination is still being defined. Cleanup goals for the soils will be set at levels protective of industrial workers and researchers and will be protective of the groundwater to the maximum extent practicable. Cleanup goals for groundwater will be set at MCLs. However, groundwater will be allowed to reach MCL levels through monitored natural attenuation. Institutional controls will prevent unacceptable uses of the groundwater.

DOE anticipates that DOE/EM remediation and long-term surveillance and maintenance activities (for the operational phase) for remediated release sites of the Four Mile Branch portion will be completed by 2036. Periodic monitoring and institutional controls will be implemented and deed restrictions will be required in the event that the property is transferred to other ownership.

3.10.5 Estimated Long-Term Stewardship Costs for the Four Mile Branch Watershed Portion

The table below provides the estimated cost for the operating phase of long-term stewardship for the Four Mile Branch portion for areas completed by the end of FY 2006. The cost estimate includes costs for well monitoring, operation and maintenance of treatment facilities, and maintenance of institutional and engineered controls, along with compliance support.

Four Mile Branch Portion Long-Term Stewardship Costs (Constant Year 2000 Dollars)							
FY 2000 - FY 2010	***FY 2011 - FY 2020***	***FY 2021 - FY 2030***	***FY 2031 – FY 2040***	***FY 2041 – FY 2050***	***FY 2051 - FY 2060***	***FY 2061 - FY 2070***	***Estimated Total***
$113,474,000	$2,393,000	$1,582,000	$695,000	$0	$0	$0	$118,144,000

The confidence level for the cost estimate is high based on conditions and agreements within the latest approved Federal Facility Agreement and applicable requirements. However, DOE acknowledges that milestones could change based on future negotiations with regulators as new work scope is identified.

3.11 Savannah River and Floodplain Swamp Watershed Portion

The Savannah River and Floodplain Swamp watershed contains 50 contaminated hectares (123 contaminated acres) that will be in long-term stewardship by 2006. The watershed is on the western boundary of SRS, about 31 kilometers (19 miles) long and eight kilometers (five miles) wide, and encompasses two major operational areas of the Site (the TNX and D Areas), as well as a few small waste sites on the fringe of M Area in the Upper Three Runs watershed and throughout the portion. The TNX Area, M Area, and parts of the D Area were used for the disposal of debris, oil, and chemicals (in seepage basins, buried rubble pits, a burial ground, and an ash basin). The TNX Area was also used to conduct nuclear pilot plant research projects. These activities resulted in soil and groundwater contamination by metals, VOCs, and radionuclides.

SAVANNAH RIVER AND FLOODPLAIN SWAMP WATERSHED PORTION HIGHLIGHTS

Major Long-Term Stewardship Activities - well monitoring; operation/maintenance of treatment facilities; maintenance of institutional and engineered controls; and compliance support
Portion Size - 50 hectares (123 acres)
Estimated Volume of Residual Contaminants - to be determined
Long-Term Stewardship Start-End Years - 1997-in perpetuity
Average Annual Long-Term Stewardship Costs FY2000-2003 - $454,250 (no portion-specific costs allocated for 2004-2006)

The specific waste units covered by this report are as follows:

TNX Area

- TNX Outfall Delta, Lower Discharge Gully, which contains low-level radioactive waste
- TNX Operable Unit (including the following operable units: TNX Groundwater, New TNX Seepage Basin, Old TNX Seepage Basin, and TNX Burying Ground), which is still being characterized

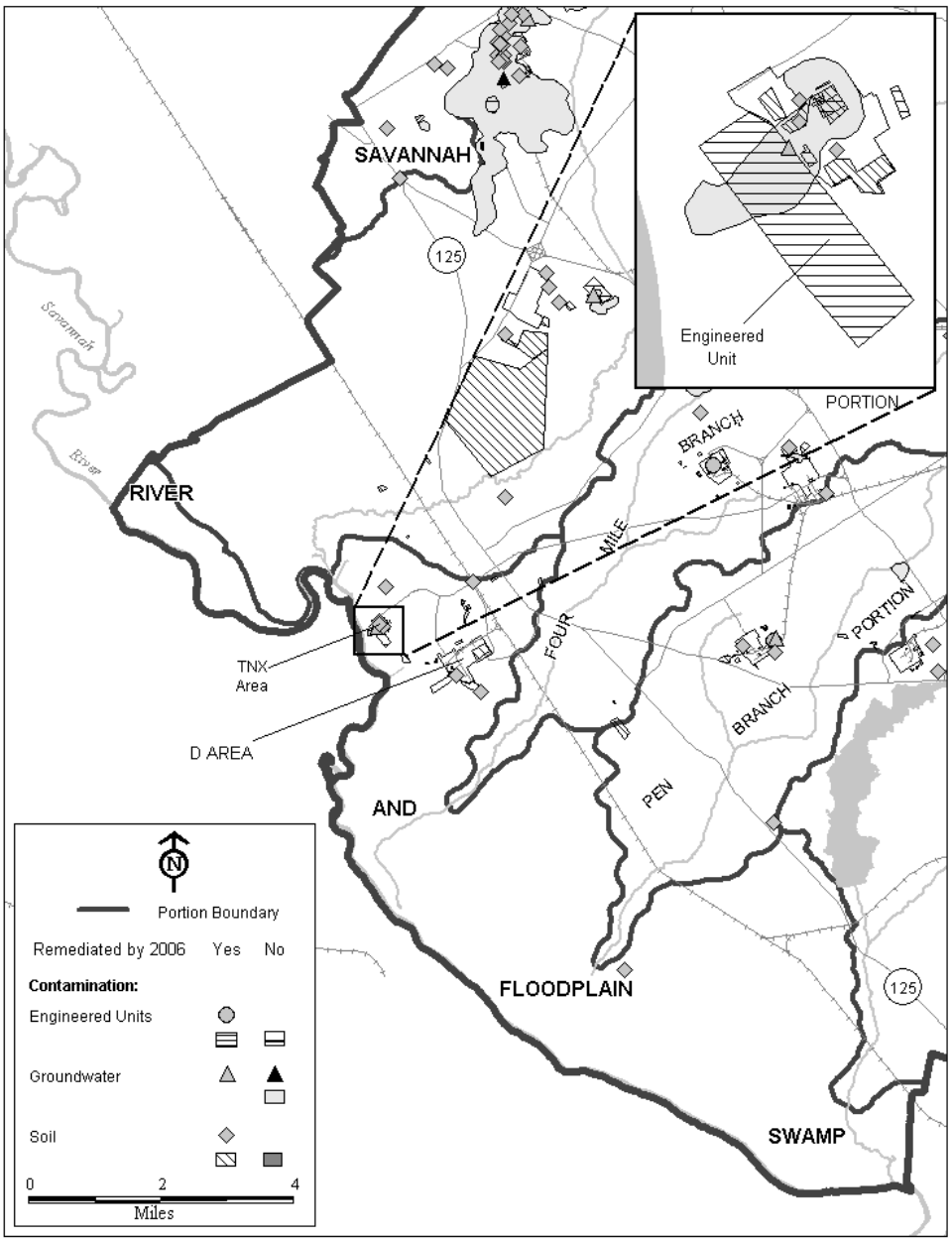
D Area

- D-Area Expanded Operable Unit, which includes the D-Area Powerhouse (containing ash and runoff from the coal pile) and D-Area Waste Oil Facility, which has groundwater contaminated with TCE, tritium and low-pH heavy metals
- D-Area Burning/Rubble Pits, which consist of sanitary (non-hazardous/non-radioactive) buried rubble and debris

A more detailed discussion of the contamination, by soil, groundwater, and engineered units, is provided below, followed by a discussion of long-term stewardship activities for this portion.

3.11.1 Soil

Soils in the Savannah River and Floodplain Swamp are contaminated with VOCs, metals, and radionuclides. Following the final decision for the Savannah River and Floodplain Swamp, it is anticipated that residual VOCs, metals, and radionuclide contamination will exist. The levels of contamination remaining will meet human health and environmental remedial goals for an industrial area. Proposed remedial actions for the soils in the Savannah



Savannah River and Floodplain Swamp

River and Floodplain Swamp portion include: leave waste in place and install a cover; excavate soils and place cover system over residual waste; stabilization of soils; and institutional controls.

The D-Area Burning/Rubble Pits operated from 1951 to 1973. During this time, spent organic solvents, waste oils, paper, plastics, wood, telephone poles, and rubber were disposed and periodically burned (typically monthly). In 1973, burning of the waste was discontinued, and a layer of soil was placed over the pit debris. The pits were then filled to capacity with rubble only. Allowable rubble waste included concrete, bricks, tile, all burning/rubble, asphalt, plastics, wallboard, rubber, and non-returnable empty drums. When the pits were filled to capacity, a layer of soil was placed over the pit, and all burning/rubble pits were closed in 1981. The two pits

are 60-plus meters (200-plus feet) long, 11-15 meters (35-50 feet) wide, and 3 meters (10 feet) deep. Iron, lead, and manganese have exceeded EPA maximum concentration levels at least once in the groundwater monitoring wells. Low concentrations of arsenic, barium, chromium, copper, lead, mercury, nickel, and selenium were detected in soil samples from the pits. Low-to-moderate concentrations of semi-volatile organic compounds (components of waste oil, pesticides/herbicides, and wood preservatives) and very low levels of radionuclide indicators have also been detected). The quantities of contaminants are unknown at this time.

The D-Area Waste Oil Facility, which is part of the D-Area Expanded Operable Unit, contains contaminated soil beneath the facility that will be remediated by soil vapor extraction.

3.11.2 Groundwater

The groundwater under the Savannah River and Floodplain Swamp is contaminated with volatile organic compounds and tritium. Following the final decision for the groundwater, it is anticipated that residual VOCs and tritium will remain in the groundwater. Tritium will eventually decay to below MCLs. Proposed remedial actions for the VOCs include: soil vapor extraction and air sparging, Geosiphon, permeable barriers, and monitored natural attenuation. Proposed remedial actions for tritium include monitored natural attenuation.

The VOC contamination plume at TNX outcrops 201 meters (660 feet) from the river, and the groundwater contaminants include VOCs, nitrates, and uranium and daughter products. Currently, there are no offsite risks from the groundwater contamination. The interim remedial action includes an Air Stripper, with four collection wells that begin remediation at the leading edge of the plume. Since startup, 132 million liters (35 million gallons) of groundwater have been remediated. In addition to aggressive air stripping technology, an innovative passive technology called Geosiphon has also been deployed at TNX. Contaminated water is drawn through an underground cell containing iron filings. As the TCE-contaminated groundwater is flushed from the Geosiphon cell to the surface, the TCE is remediated. The Geosiphon cell utilizes a gravity feed design to discharge the clean water toward the Savannah River without mechanical pumping.

Characterization of the D-Area Expanded Operable Unit began in 1998 and has identified extensive groundwater contamination and large volumes of source material. Groundwater in the lower D Area is contaminated with TCE, tritium, and heavy metals. The presence of heavy metals is primarily due to low pH coal leachate. The commingled plume is about 202 hectares (500) acres. The TCE portion of this plume is about 121 hectares (300 acres), while the tritium plume is about 36 hectares (90 acres), and the heavy metal (low pH) plume is about 81 hectares (200 acres). The estimated volume of contaminated groundwater is over 5.7 billion liters (1.5 billion gallons) and extends as close as 150 meters (500 feet) from the Savannah River. Since this project is in the early stages of investigation, no definitive remediation strategy has been approved. Characterization and evaluation of data will be completed in 2002, with a risk evaluation and remedial options to be completed in 2003.

STRATEGY FOR CONTINUED REMEDIATION SUCCESS IN THE FLOOD PLAIN SWAMP PORTION

- Asphalt-cover Hg sources at the Old TNX Seepage Basin.
- Reduce VOC sources in the vadose zone using Soil Vapor Extraction to levels that will not impact groundwater.
- Maintain existing Interim Action (pump and treat system) to prevent continued migration of high concentration VOC plume into Swamp.
- Use monitored natural attenuation strategy to allow low concentrations of VOCs in the distal groundwater plumes to attenuate.
- Pursue excavation/phytostabilization of the Ash Basin
- Pursue excavation/neutralization of the coal pile runoff basin.
- Pursue possible phytoremediation alternatives for additional source areas

The D-Area Powerhouse (part of the D-Area Expanded Operable Unit) is currently operating and generating ash and runoff from the coal pile into the coal pile runoff basin. A remediation strategy is excavation/ phytostabilization.

3.11.3 Engineered Units

The Old TNX Seepage Basin unit, the New TNX Seepage Basin unit, and TNX Burying Ground are included in the TNX Operable Unit. During its operation, the Old TNX Seepage Basin would periodically overflow, and the liquids would flow down the hill to the west and discharge into the Savannah River floodplain. This periodic overflowing, and the breaching of the western wall of the basin in 1981, resulted in the creation of a deep incised gully (the Lower Discharge Gully) and the TNX Outfall Delta in the TNX swamp. The swamp is heavily wooded lowland, located between the TNX facility and the Savannah River. Additional characterization of the TNX Outfall Delta is required. This additional data will provide a better understanding of the nature and extent of contamination at the TNX Outfall Delta unit.

The TNX Outfall Delta, Lower Discharge Gully, is a seepage overflow basin that consists of low-level radioactive waste. A commercial vendor is being used to collect and dispose of this waste. The Old TNX Seepage Basin, which is included in the TNX Operable Unit, contains both low-level mixed waste and low-level radioactive soils and sediments. The New TNX Seepage Basin, which is also part of the TNX Operable Unit, received process wastes. Chemical stabilization, soil mixing, and grouting are proposed remediation methods.

3.11.4 Long-Term Stewardship Activities

The Savannah River and Floodplain Swamp watershed has an anticipated end state that is limited to activities specified in the Site's Industrial Support Zone. These activities include industry support activities and research and development. Institutional controls will be implemented to prevent residential use and excavation of buried/stabilized wastes and inappropriate use of the groundwater. At this time, the volume of residual contamination for the groundwater and soil cannot be estimated. This is because the area is currently undergoing remedial investigation. Once the remedial investigation has been completed and final remedial goals have been established, a volume estimate can be calculated.

Cleanup goals for the soils will be set at levels protective of industrial workers and researchers and will be protective of the groundwater to the maximum extent practicable. Cleanup goals for groundwater will be set at MCLs. However, groundwater will be allowed to reach MCL levels through monitored natural attenuation. Institutional controls will prevent unacceptable uses of the groundwater

DOE anticipates that DOE/EM remediation activities and long-term surveillance and maintenance activities (for the operational phase) for remediated release sites of the Savannah River and Floodplain Swamp portion will be completed by 2047. Periodic monitoring and institutional controls will be implemented and deed restrictions will be required in the event that the property is transferred to other ownership.

3.11.5 Estimated Long-Term Stewardship Costs for the Savannah River and Floodplain Swamp Watershed Portion

The table below provides the estimated cost for the operating phase of long-term stewardship for the Savannah River and Floodplain Swamp portion for areas completed by the end of FY 2006. The cost estimate includes costs for well monitoring, operation and maintenance of treatment facilities, and maintenance of institutional and engineered controls, along with compliance support.

Savannah River and Floodplain Swamp Watershed Portion Long-Term Stewardship Costs (Constant Year 2000 Dollars)							
FY 2000 - FY 2010	***FY 2011 - FY 2020***	***FY 2021 - FY 2030***	***FY 2031 – FY 2040***	***FY 2041 - FY 2050***	***FY 2051 - FY 2060***	***FY 2061 - FY 2070***	***Estimated Total***
$2,069,000	$465,000	$431,000	$0	$0	$0	$0	$2,965,000

The confidence level for the cost estimate is high based on conditions and agreements within the latest approved Federal Facility Agreement and applicable permits, agreements, consent orders, laws, and regulations. However, DOE acknowledges that milestones could change based on future negotiations with regulators as new work scope is identified.

4.0 FUTURE USES

According to the March 1998 Future Use Plan, SRS will remain under federal government ownership under its current boundaries in perpetuity. DOE will be the SRS landlord until 2028, after which Site landlord responsibilities is expected to be transferred to another federal government entity. The future uses of SRS are not expected to change significantly from their current uses. The SRS Future Use Plan anticipates that the SRS will operate as a controlled access facility under its current boundaries and will require institutional controls in perpetuity. All areas with institutional controls will require federal oversight until the property is transferred with appropriate deed restrictions.

SRS is divided into three principal land use planning zones, as depicted in the table below. The most intensive future industrial and waste management uses of SRS will occur in the Site's Industrial Zone, close to the center of the Site, with less intensive research and development, technology development, and other uses in the Site's Industrial Support Zone, and limited controlled access for recreational activities in the General Support Use Zone. Residential land use will not be allowed in any of the SRS land use zones at any time in the future. Site infrastructure, security, and other institutional controls will be maintained in all zones in perpetuity.

SRS Land Use Planning Zones		
Site Industrial Zone	***Site Industrial Support Zone***	***Site General Support Use Zone***
Located close to Site's center to minimize effect on surrounding communities	Accommodates uses of decreasing intensity from Site Industrial Zone	More open and accessible than the other two Site zones
Surrounded by safety and security buffer; controlled site access	Administrative areas serve as buffer and transitional zones between intensely developed and less developed areas; controlled site access	Zone still required as part of safety and security buffer; some uses may include temporary and restricted access by public
Most intensive (highest impact) uses occur in this zone	Activities have much less impact than those in Site Industrial Zone	Includes ecological research and natural resource management activities

SRS Land Use Planning Zones		
Site Industrial Zone	***Site Industrial Support Zone***	***Site General Support Use Zone***
Primary activities grouped according to following uses: - Heavy Industrial Non-Nuclear - Heavy Industrial Nuclear - Light Industrial - Waste Operations	Primary allowable activities grouped according to following uses: - Administrative (office parks, laboratories) - Research and Technology Dev. - Resource Extraction - Storage and Warehousing - Natural Resources Management	Other primary allowable uses include: - Controlled Recreation - Public Education

For additional information about the Savannah River Site, please contact:

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